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Key to the commoner trees, shrubs, and woody climbers of the "Sholas" in and about Ootacamund, and Coonoor, the Nilgiris.

(Based mostly on vegetative characters.)

By, Rao Sahib V. N. Seshagiri Rao, B. A., M. F. S.,
Instructor, Madras Forest College.

The students of the Madras Forest College spend their 6 weeks' hill tour from the first week of April to the third week of May on the Nilgiris every year, in the vicinity of Ootacamund and Coonoor; the first year students camp at "Bandy Shola" 4 miles north-east of Coonoor, and the second year at "Aramby Shola" 1½ miles north-west of Ootacamund.

One of the principal objects of this tour is to study the flora of the picturesque natural forests, locally known as "Sholas" and the Australian species introduced on these hills. The vegetation on the hills is so widely different from any that the student has hitherto seen; and this opportunity was availed of to list out the common trees, shrubs and climbers close to the camps.

H. [illegible]

(Extract from an article in M.F.C. Mag. p.)

For a proper study of the interesting and varied flora of these hills, some general idea of the topography and geology of the locality will be useful.

Area and boundaries.

The Nilgiri District is the smallest in the Madras Presidency. It is bounded on the north by Mysore; on the east and south-east by the Coimbatore District; on the south, by portions of Malabar and Coimbatore; and on the west, by Malabar. Its extreme length from east to west is 48 miles and the width from north to south is 36 miles, giving an area of 957 sq. miles.

Topography and geology.

The Nilgiri Hills (The Blue Mountains) consist of a mountain plateau formed by 3 distinct ranges or groups of hills, each rising gradually towards the summit at Doddabetta (8761′) the loftiest point. The Moyar river separates these mountains on the north, from the Mysore plateau. The tableland is undulated and divided by narrow valleys, each forming the bed of either a stream or a swamp. The principal rock is finely grained gneiss which on disintegration forms a rich loam, varying in colour from light red to dark chocolate. The soil is fertile and well drained.

Climate.

"Situated as the Nilgiris are, at an average elevation of about 6500′, equidistant (more or less) from the two seas, sharing the two monsoons, and isolated from mountains of similar heights, they possess a climate which for equability of temperature, for mildly invigorating qualities, for great salubrity, and for immunity from the disturbing influences common to the climate of most hill stations, is almost unrivalled in the tropics".

Coonoor situated about 12 miles (by road) south east of Ootacamund, is preferred to Ootacamund on account of its shelter from the South West Monsoon. The mean annual temperature of Coonoor is 62°. (6 degrees hotter than Ooty.) In the warmer months the thermometer fluctuates between 55 and 75 degrees, and in the cold weather between 38° and 68°.

The average rainfall of Coonoor is 65″ and that of Ootacamund 50″. The South West Monsoon gives the heaviest rainfall in the neighbourhood of Ootacamund i.e., in the north western section, but hardly touches the eastern portion of the plateau. Similarly the North East Monsoon affects only the eastern portion and leaves the north west section least benefitted.

General Character of the Flora.

The Nilgiris possess a varied and interestfng flora exceedingly numerous in genera and species. The forests vary in their condition and character of growth according as they occupy the eastern or western sides of the hills. They can be classified roughly into three groups :—1. The deciduous forests of the slopes including those of the Moyar valley; (2) The evergreen forests of the slopes including parts of Wynaad. 3. The "Sholas" of the plateau with the grass lands between.

Of these types, we are at present concerned with the last the "Sholas," which are probably the most interesting. The character of these forests approaches the Subtropical. They consist of the slow growing evergreen species which are seldom over 50 or 60 ft. in height. They are dense and have a refreshing colour of luxuriance and the tints of young leaves are very beautiful, more so in summer. The vegetation is bespangled with the most beautiful flowers of variegated colours. A striking peculiarity of these forests is that they are destitute of dense underwoods. *Myrtaceae*, *Laurineae*, and *Styra-*

Monta
Temp

ceae are the orders most represented by trees and the undergrowth is chiefly composed of *Rubiaceous* and *Acanthaceous* shrubs.

As already stated, the character of these forests changes with the aspect and the rain fall. The "Sholas" of Coonoor differ from those of Ooty and Kotagiri. Some plants found in Ooty do not thrive on lower mountain tops. Some Coonoor plants, on the other hand, find the higher levels of Ooty beyond their range. A few such cases are noted below :—

Viburnum hebanthum, a small spreading tree with flat topped corymbs of greenish flowers so common at Aramby shola, Ootacamund, does not occur at Coonoor, at any rate, not so commonly. The odour of its greenish flowers which appear in March, is very offensive. Visitors to these "sholas" are puzzled by the strange odour, not knowing its origin. The commonest *Compositeae* at Coonoor, *Vernonia monosis*, is not found in Ooty. *Sideroxylon tomentosum* which is abundant in Ooty does not seem to thrive in Coonoor. *Mahonia leschenaulti*, the Holly-Leaf Barberry, a large shrub of the north temperate regions, with its compound leaves and yellow globular flowers is met with only in Ooty. *Symplocos* which is tolerably plentiful in Coonoor, is rare in Ooty. Of the *Apocynaceae* there seems to be but one representative in Coonoor, *Rauwolfia densiflora*. This is not noticed in Ooty. *Elaeocarpus oblongus*, and *E. munroii*, with their elegant unilateral flowers, and the large handsome leaves which turn bright red before falling, attract any casual observer in Coonoor ; these are not seen in Ooty. *Hydnocarpus alpina* with its long acuminate leaves flushing red, and very large tomentose fruits, *Ternstroemia japonica* with obovate leaves, red petioles and yellowish flowers, which are common in Coonoor are not found in

Ooty. *Miliosma arnottiana* (the Spirae tree) is very common at Coonoor but very rare in Ooty.

The above cases illustrate the difference in vegetation in these localities, due to the difference in the rain-; fall and the elevation. There is, however, a great part which is common both to Ooty and Coonoor.

A few among the trees common to both places are:—

Michelia nilagirica, the "Champak of the hills" with its large white fragrant flowers and scarlet seeds. the three *Syzygiums*, *S. montanum*, *arnottianum*, *jambolanum* with their dense green foliage of coriaceous leaves; *Ilex denticulata*, and *I. wightiana*, with their thick small leaves and red berries; *Gordonia obtusa* with its pale green leaves, large white flowers, and 5 angled fruits with winged seeds; evil smelling *Mappias*; *Euonymus pendulus* and *E. crenulatus* with their dark brick-red pendulous arillate seeds.

Among the shrubs, the most common are *Rhododendron nilagiricum* with its elliptical rusty-backed coriceous leaves and dark crimson flowers; *Rhodomyrtus tomentosa* (the Nilgiri gooseberry); the sweet scented *Lilium nilgiricum* (Nilgiri lily) *Vacciniums* (*V. leschenaulti*, and *V. nilgherrense*) and *Strobilanthes*, especially *Strobilanthes Kunthianus*, with its blue flowers which are said to have given the hills the name of Blue Mountains!

Among the climbers, the brambles are the most common. *Rubus ellipticus* (Yellow Bramble) with its pinnately trifoliate leaves, and round leaftets, white flowers and yellow berries; *Rubus lasiocarpus* with white stems, pink flowers and black berries; *Piper schmidtii* with its aromatic leaves, and lax dense spikes of yellow pepper climbing with roots at swollen nodes; *Polygonum* *chinensis* with its ochreaceous stipules, swollen nodes and reddish tinted leaves; *Passiflora leschenaultii* with its half-moon shaped leaves, axillary tendrils and white flowers; the handsome climbing *Eleagnus*, the underside of whose leaves has a sheen like silver, and with pink coloured edible fruits. Ebenaceae does not seem to be represented on these hills.

A key based chiefly on forest characters is appended for the easy identification of the commoner trees, shrubs and climbers of the above " Sholas ".

The exotics are separately catalogued.

My thanks are due to Mr. G. Viswanatham, B. A., Curator, Forest Museum, for valuable help rendered in the compilation of the key. The following books have been freely consulted :

1. " The Flora of the South Indian Hill Stations " —By, P. F. Fyson.
2. " Indian Trees "—By, D. Brandis.
3. " Flora of the Presidency of Madras "—By, J. S. Gamble.

—:o:—

List of abbreviations used.

Bk.	Bark.	Alt.	Alternate.
Ls.	Leaves (blade)	Nd.	Nerved.
Pet.	Petiole.	Ns.	Nerves.
Stip.	Stipulate.	Sec. ns.	Secondary nerves.
Stips.	Stipules.	Infl.	Inflorescence.
In.	Inch or inches.	Fls.	Flowers.
Simp.	Simple.	Fr.	Fruit.
Compd.	Compound.		

SCHEME OF THE KEY.

A. TREES.

I. LEAVES SIMPLE OR UNIFOLIATE.

1. *Leaves alternate.*
    - (1) Stipulate.
        - i. Stipules minute.
        - ii. Stipules large.
    - (2) Exstipulate.
        - i. Leaves crowded at the end of branches.
            - (i) Trees with milky juice.
            - (ii) Trees with no milky juice.
        - ii. Leaves scattered.
            - (i) Calyx tube adnate to ovary.
            - (ii) Calyx tube not adnate to ovary.
                - a. Aromatic trees.
                - b. Trees not wholly aromatic.
                - c. Trees non-aromatic.
2. *Leaves opposite.*
    - (1) Exstipulate.
        - i. Trees exuding coloured juice.
        - ii. Trees not exuding coloured juice.
            - (i) Trees aromatic.
            - (ii) Trees not aromatic.
            - (iii) Trees with evil smelling leaves.
            - (iv) Trees neither aromatic nor evil smelling.
    - (2) Stipulate.
        - i. Stipules inter-, or intra-, petiolar.
        - ii. Stipules not interpetiolar.

II. LEAVES COMPOUND.

- 1. *Leaves alternate.*
  - (1) Leaves pinnate.
    - i. Paripinnate.
    - ii. Imparipinnate.
    - iii. Leaves bi-pinnate.
  - (2) Ls. palmate.
    - i. Leaflets more than three.
    - ii. Leaflets 3.
- 2. *Leaves opposite.*
  - (i) Ls. pinnate.
  - (ii) Ls. stipulate.
  - (iii) Ls. exstipulate.

B. SHRUBS AND UNDER-SHRUBS.

I. LS. SIMPLE.

- 1. *Ls. alternate.*
  - (1) Thorny
  - (2) Not thorny.
- 2. *Ls. opposite.*
  - (1) Thorny.
  - (2) Not thorny.
    - i. Stips. intra-petiolar.
    - ii. Stips. not intra-petiolar.
      - (i) Juice milky.
      - (ii) Juice not milky.

II. LS. COMPOUND.

Ls. trifoliate,

C. CLIMBERS.

I. LS. SIMPLE.

- 1. *Ls. alternate.*
  - (1) Tendril climbers.
  - (2) No tendrils.
    - (i) Ls. palminerved.
    - (ii) Ls. penninerved.
- 2. *Ls. opposite.*
  - (i) Juice milky.
  - (ii) Juice not milky.

II. LS. COMPOUND (PINNATE).

- 1. Ls. alternate.
- 2. Ls. opposite.

III. LS. COMPOUND (BI-PINNATE).

A. TREES.

I. Leaves simple. (78)*

A. Alternate. (51)

a. Stipulate. (25)

1. Stipules minute, (22)

i. Ls. with 3–5 basal nerves. (7)

(i) Ls. crenate or serrate. (5)

x. Trees spinescent.

Fls. bisexual; fr , green, when raw ; yellow when ripe; globose berry, 2/3 in. diam. — 1. *Scolopia crenata.*

xx. Trees not spinescent.

* Ls. glaucous beneath, glabrous above; fls. in catkins; fr. capsule; 1/8-1/6 in. Seeds with tufts of hairs. (branchlets and petioles of leaves red) — 2. *Salix tetrasperma.*

** Ls. not glaucous; base oblique.

£. Young ls. not red.

Ls. white, tomentose below, scabrid above, serrulate. Fls. in lax cymes. Bark; lenticellate, ringed with scars. Fr. a yellow drupe. — 3. *Trema orientalis.*

££. Young ls. red.

Lower half entire. Fr. a berry of the size of a pea on a slender stalk. — 4. *Celtis tetrandra.*

(ii) Ls. entire. Base equal sided. Young ls. red.

x. Blade 3–6 in., underside not glandular; petiole less than 1 in. — 5. *Celtis* † *wightii.*

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* Such a number in brackets refers to the number of the tree beginning with the opposite characteristics.

† In accordance with the convention in the Forest department of India, *all* specific names begin with a small letter.

xx. Blade 4–9 in.; underside with red glands, petiole 2–3 in. 6. *Mallotus philippinensis.*

ii. Ls. penninerved.

(i) Ls. more than 3 in. long. (19)

x. Young ls. red; branches crooked.

* Ls. not distichous; no smell. Fls. unisexual, dioecious; fr. ovoid berry, upto 4 in. diam., tomentose with hard rind. 7. *Hydnocarpus alpina.*

** Ls. distichous, emitting a smell. Fls. unisexual, monoecious; midrib of leaf pinkish; capsule 1/3–3/4 in. long, pubescent; seeds orange red. 8. *Glochidon neilgherrense.*

xx. Leaves withering red. (16)

* Fr. enclosed within the calyx tube; fls. bisexual; nerves slender.

(a) Fr. a berry.

£. Margins of ls. crenate or serrate.
Ls. rounded, and sometimes unequal, at base; petiole 1½ in., red. 9. *Photinia lindleyana.*

££. Margins entire, branches angular. 10. *Photinia notoniana.*

(aa) Fr. a capsule.
Ls. entire, biseriate, pellucid punctate. drying black. 11. *Casearia coriacea.*

** Fr. not enclosed in the calyx tube. Fr. a drupe.

(a) Fls. bisexual. (15)

£. Trees growing in the open. Ls. broadly elliptic, flat. Pet. ¾–1 in., with 2 minute glands at apex. 12. *Elaeocarpus oblongus.*

££. Shola trees.

&. Ls. round-backed, like an inverted boat, rusty-downy below, glabrous above. 13. *Elaeocarpus ferrugineus.*

&&. Ls. broadly caudate acuminate, crowded at the ends of branches; glands at the axils of ns. 14. *Elaeocarpus munroii.*

(aa) Fls. unisexual. Ls. elliptic oblong, glabrous and shining above, 5–8 in. long by $1\frac{1}{2}$–$2\frac{1}{4}$ in.; fr. purplish-red, sour, edible. 15. *Antidesma menasu.*

xxx. Ls. not flushing or withering red.

* Ls. glaucous beneath, chartaceous, drying black; margins recurved; pet. red $\frac{1}{2}$-2 in. with prominent leaf and bud scars. 16. *Daphniphyllum glaucescens.*

** Ls. not glaucous, thick, petiole stout, not red; Ls. bark and flowers smelling prussic acid (almond oil). Glands at the base of leaves.

(a) Ls. ovate, obtusely acute at apex. very thick and dark; drupe not notched at tip. Bark dark, cracked. 17. *Pygeum wightianum.*

(b) Ls. lanceolate, long acuminate, light green; drupe slightly notched at top. Bark smooth, brown. 18. *Pygeum gardnerii.*

ii. Ls. less than 3 in. long.

  (i) Margins entire.

    x. Ls. withering red, distichous, densely tomentose, emitting a smell.
      Capsule depressed, globose with 5–6 rounded bilobed segments. Seeds red. — 19. *Glochidion velutinum.*

    xx. Ls. not withering red, not distichous, not emitting smell, rigidly coriaceous; petiole ½–2/3 in.; fls. in umbels. — 20. *Ilex wightiana.*

  (ii) Margins denate.
      Fls. in cymes. — 21. *Ilex denticulata.*

2. Stipules large.

  i. Ls peltate. orbicular, 4–8 in. long, pet. 3–8 in., young ls. tawny-tomentose; basal nerves 10.
  Ovary 1-celled, covered with yellowish round resinous glands. — 22. *Macaranga indica.*

  ii. Ls. not peltate.

    x. Exuding milky juice.
    Fr. a fig, solitary, axillary, ½ in. or less, purple. Ls. ovate, base cuneate, 4 in. × 3 in.; nerves 6–10 pairs, petiole ½–2 in. — 23. *Ficus tseila.*

    xx. No milky juice.
    Branches with stipulary scars. Stipules convolute; Fls. trimerous, Fr. on a gynophore; a lax, elongate spike of follicles. Seeds red. — 24. *Michelia nilagirica.*

b. Exstipulate.

  1. Unifoliate, gland dotted. — 25. *Acronychia laurifolia.*

  2. Not unifoliate.

    (i) Ls. crowded at ends of branchlets: (34)

      x. Trees exuded milky juice. (28)

        * Branchlets spinescent (usually). Young ls. scarlet, young shoots tawny tomentose;

staminodes present. Ls. under 3 in.; sec. ns. distant. Fr. yellow, 26. *Sideroxylon tomentosum.*

** Branchlets not spinescent; staminodes absent; ls. 3 in. and more; sec. ns. regular parallel and close set. 27. *Isonandra candolleana.*

xx. No milky juice.

* Branches in whorls. (31)

x. Fls. bisexual.

£. Petals clawed, anthers versatile. Fr. a capsule, seeds sticky.

(1) Ls. elliptic 2–3 in.; young branches puberulous; Fls. in terminal umbels. 28. *Pittosporum tetraspermum.*

(2) Ls. ovate, 1–2 in.; branches glabrous, Fls. in axillary corymbs. 29. *Pittospermum nilgherense.*

xx. Fls. unisexual. Aromatic trees. Ls. acute or acuminate, attenuate at base, fulvous villous beneath, upto 10 in. by 3 in 30. *Actinodaphne hirsuta.*

** Branches not in whorls.

(1) Ls. entire, obovate, margin reflexed, petiole red. Ls, less than 3″, leathery, pet. ¼ in., Fr. berry. Seeds red. Fls. bisexual. 31. *Ternstroemia japonica.*

(2) Ls. not entire, margin not reflexed, petiole not red.

(i) Ls. serrate; Fr. a berry; seeds not winged; fls. unisexual, $\frac{1}{6}$ in. across. 32. *Eurya japonica.*

(ii) Ls. crenate, fr. a capsule, seeds winged. fls. bisexual 1 in. across. 33. *Gordonia obtusa.*

(ii) Ls. scattered. (51)

a. Calyx tube adnate to ovary, margins of ls. not entire. (38)

1. Ls. turning yellow, young ls. purple, buds with external scales, stamens adnate to petals.

i. Ls. serrate right to the base. 34. *Symplocos foliosa.*

ii. Ls. with serrations upto the middle. 35. *Symplocos spicata.*

2. Ls. turning red, buds with no external scales; stamens free, corolla urceolate,

i. Ls. less than 3 in. Fls. pink. 36. *Vaccinum leschenaultii.*

ii. Ls. more than 3 in. Fls. white. 37. *Vaccinum nilgherrense.*

b. Calyx tube (Perianth) not adnate to ovary. Margins of leaves entire.

1. Trees wholly aromatic–(Ls. Bark, etc., with sweet cinnamomous smell). (45)

i. Fls. small, clustered inside involucre of bracts. (42)

(i) Ls. triple nerved. Fls. dioecious, perianth 4. 38. *Neolitsea zeylanica.*

(ii) Ls. penninerved, perianth on a deep cup, cup as deep as wide.

x. A small tree.
Ls. elliptic oblong, glabrous, upto 6 in. long. Umbellules solitary. Berry globose, 0.25 in. diameter. 39. *Litsea ligustrina.*

xx. Large evergreen trees.

* Ls. upto 4 in. by 2 in., ns. 4–8 pairs. Ls. obovate, fulvous pubescent beneath. Umbellules in racemes. berry ovoid, ½ to ¾ in., in cup shaped perianth tube. 40. *Litsea wightiana.*

** Ls. upto 10 in. × 4 in. Ns. 10–15 pairs. — 41. *Litsea floribunda.*

ii. Fls. in terminal panicles; many.

a. Ls. glaucous beneath.

(i) Ls. 3–5 nerved.
Ls. upto 4 in. long and 3 in. broad. Ns. from $\frac{1}{3}$ to $\frac{1}{2}$ in. above base. — 42. *Cinnamomum wighiii.*

(ii) Ls. penninerved.
Perianth lobes reflexed. Ls. upto 8 in.; Ns. 12 pairs. — 43. *Machilus macrantha.*

b. Ls. not glaucous beneath.
Ls. upto 6 in. Ns.; numerous, close, parallel. Perianth lobes erect; fls. in lax, axillary or subterminal panicles. — 44. *Phoebe wightii*, Meissn (= *P. paniculata.* Nees),

2. Trees not wholly aromatic. (48)

(i) Trees exuding milky acrid juice.
Ls. glaucous underneath, elliptic oblong, 3 to 7 in., Ns. 15–20 pairs, meeting near margin in loops. Fr. a red pyriform edible drupe $\frac{1}{4}$–$\frac{1}{2}$ in, in diameter. — 45. *Nothopegia beddomei*, Gamb.

(ii) Trees not exuding milky acrid juice.

x. Ls. alone sweet scented.
Flowers axillary solitary or in few-flowered cymes. Ls. equally green on both sides, elliptic obovate, about 2 in. by 1 in. Fr. pale yellow, 2 in. long, capped by the 5 angled stigma — 46. *Gomphandra coriacea.*

xx. Flowers alone sweet scented:
Ls, obovate, more than 6 in. long; youngest parts and underside densely brown tomentose. Fls. small, in heads,

sweet scented. Persistent calyx turned into pappus; Fls. purple. Ls. obovate, more than 6 in. long; young parts and underside of ls. densely brown tomentose. 47. *Vernonia monosis.*

3. Trees with evil smelling flowers: (49) Fls. in large terminal cymose corymbs, Ls. flaccid and usually drooping, 5–12 in. 48. *Mappia foetida.*

4. Trees neither aromatic nor evil smelling:

  (i) Fls. in panicles; calyx lobe persistent, surrounded by bracteoles.

   x. Trees. Ls. 4–8 in.; underside densely tawny tomentose. Veins reddish and prominent beneath. panicles 6–8 in. 49. *Meliosma wightii.*

   xx. Small trees. Ls. 5–16 in.; underside glabrous. Distantly toothed when young. 50. *Meliosma simplicifolia.*

II. Leaves simple.

 B. Opposite.

  a. Exstipulate.

   1. Trees exuding yellow or greenish juice. (53)

    x. Ls. coriaceous with close-set faint parallel ns. Fls. unisexual. Fr. ovoid berry, 1½–2 in. furrowed:

    xx. * Male pedicels 0.3 in.–0.7 in., anthers 2-celled. 51. *Garcinia cambogia.*

    ** Male pedicel 0.2 in.–0.3 in., anthers 4-celled. 52. *Garcinia cowa.*

   2. Trees not exuding any coloured juice.

    x. Ls. unfoliate, pellucid punctate, Ls. Elliptic, or obovate, entire, 3–4 in. Pet. 1 in. long. 53. *Melicope indica.*

xx. Ls. not unifoliate. No oil glands.

* Ls. with intramarginal nerve. (60)

£. Lateral ns. distinct, numerous, fine, parallel. Flowers in cymose panicles ; calyx egg shaped ; stamens indefinite. Anthers versatile.

&. Ls. never attaining more than 4 in.

(a) Ls. $2\frac{1}{2} \times 1\frac{1}{4}$, elliptic cordate acuminate rounded at base, finely dotted on both sides, drooping. Young ls. red. Pet. $\frac{1}{2}$–$\frac{3}{4}$ in. reddish. 54. *Syzygium arnottianum.*

(b) Ls. obovate obtuse, emarginate, 1 in. long, less than 1 in. broad, close-set, stiff. petiole 1/6 in. 55. *Syzygium calophyllifolium.*

&&. Ls. attaining more than 4 in.

(a) Branchlets thick, acutely quadrangular, and narrowly winged. Ls. elliptic obtuse, 6 in. × 3 in., lateral Ns. distant, 12-18 pairs. Pet $\frac{1}{4}$–$\frac{1}{2}$ in. 56. *Syzygium montanum.*

(b) Branches terete; Ls. up to 6 in., elliptic lanceolate, acute, ns. close and parallel ; petiole $\frac{1}{2}$–1 in. Panicles in axils of fallen ls. (cf. terminal in 54-56). 57. *Syzygium jambolanum.*

££. Lateral nerves obscure, few. Fls. in sessile compact fascicles (generally blue) stamens definite, anthers opening by slits.

(a) Ls. sessile, cordate, ovate, obtusely acute, 2½ × 1½ in. Petiole ¼–¼ in. 58. *Memecylon malabaricum.*

(b) Ls. petiolate, elliptic obovate, under 2 in. × 1 in. 59. *Memecylon lushingtonii.*

** Ls. with no intramarginal nerve.

£. Ls. evil-smelling when crushed; joined by a scar (no definite stipule), tufts of hairs on the nerve axils. Ns. strong. Fr. a drupe. Ovary inferior.

&. Ls. entire acuminate, margins recurved, underside with rust coloured scales or glands. Bracts persistent. 60. *Viburnum acuminatum.*

&&. Margins not recurved, no peltate scales on the back.

(a) Ls. entire, shallow toothed, Bracts not conspicuous. 4—6 pairs of ns. 61. *Viburnum coriaceum.*

(b) Ls. sinuate, 4 pairs of ns.: bracts linear, persistent; foliage light green, emit especially when rotting a strong foetid smell. 62. *Viburnum hebanthum.*

(c) Ls, dentate with crimson stalks ; branches laxly spreading, forked, white barked, Fls,

in drooping racemes.
(Ls. when crushed
smell like *Premna*
Ls.) 63. *Viburnam erubescens.*

££. Ls. not evil-smelling, not joined by a scar, no hairs in the nerve axils.

&. Seeds arillate.
Ls. spreading, margins revolute ; fls. brownish purple. Fr. a 5-valved, 5-seeded capsule.

(a) Ls. elliptic, entire ; 1-3 flowered, on one inch long pedicels. 64. *Euonymus indicus.*

(b) Ls. coarsely dentate; 1–7 flowered. 65. *Euonymus crenulatus.*

&&. Seeds without aril.

(a) Ls. stiffly erect, fls. yellowish. Fr. 2-valved 1-seeded capsule on an enlarged calyx. (69)

* Branchlets thick. Fls. almost sessile in dense clusters. 66. *Microtropis ramiflora.*

** Branchlets normal. Fls. in terminal and axillary corymbs.

(1) Fr. brown, Ls. under 2 in., petals orbicular, not clawed. 67. *Microtropis microcarpa.*

(2) Fr. crimson, Ls. 2–3 in. (over 2 in.) Petals long clawed. 68. *Microtropis ovalifolia.*

(b) Ls. not stiffly erect, Fls. white.

(1) Fls. sweet scented (smelling sandal)

Ls. glandular in nerve axils, Fr. a drupe. — 69. *Olea glandulifera.*

(2) Fls. not sweet scented. Ls. not glandular. Lenticels copious. Fr. a berry. — 70. *Ligustrum roxburghii.*

b. Stipulate.

1. Stipules inter–, or intra-petiolar. (77)

(1) Calyx adnate to ovary.

i. Ovules many.

(i) Ls. 3 at each node, seeds angled, (not winged) Ls. 3–5 × 1–1¼ in., stips. recurved, bifid. Corolla lobes imbricate, entire. Bark orange red, peeling off in fibrous strips. — 71. *Wendlandia notoniana.*

(ii) Ls. two at each node Seeds winged. Ls. leathery, more than 6 in.; nerves and petioles red. Corolla lobes valvate, fringed; bracts persistent. — 72. *Cinnamomum ledgerianum.*

ii. Ovules solitary in each cell.

(i) Stipules short; branchlets angular.

x. Ls. thin, ovate, dull above hirsute beneath, 3–4 in. × 1½–2 in. Margins recurved; fls. in axillary sessile umbels. Stigma large mitriform. Bk. dark grey, marked with vertical lines. — 73. *Plectronia neilgherrensis.*

xx. Ls. thick (very coriaceous) elliptic, shining above, glabrous beneath, 4 × 2 in. Fls. in cymes. Bk. smooth. — 74. *Plectronia didyma*, Kew.

(ii) Stips. forming a complete sheath round the axis 1/8 in. above each pair, subulate. Branchlets not angular, (usually round).

Ls. coriaceous, oblong, obovate, upto 8 in. × 3 in., dark green and shining above, glabrous, rounded at base Fls. in corymbs, long peduncled, bibracteate. Corolla lobes recurved, pink or red. Style twice the length of corolla tube, exserted. Stigma 2-lobed. Bark rough, brown. 75. *Ixora notoniana.*

(2) Calyx free (not adnate to ovary).

Ls. obovate, spathulate. obtuse, fleshy, 3–7 in. long, glabrous, shining above. Fls. cream-coloured, fragrant. Fr. berry; seeds many. 76. *Fagrea obovata.*

2. Stipules neither inter–, nor intra–, petiolar:

Trees with acrid milky juice. Fr. 3-lobed capsule. Seeds with a caruncle. Ls. shallowly crenulate, 3–4 in. by 1–1¼ in., dark green, veins 16–20 pairs. 77. *Excaecaria crenulata.*

II. Leaves Compound.

A. Alternate. (86)

a. *Pinnate.* (81) and (82)

1. Bark and ls. usually bitter. Leaflets oblique. Twigs lenticellate. Fr. a capsule.

(a) Leaf paripinnate. 1–3 ft. long. Leaflets 8–30, alternate or subopposite. 2–7 in. × ¾–3 in. Panicles as long as or longer than the ls. Petals ciliate. Stamens free. Fr. septicidally septifragal. Capsule ¾ in. long, seeds winged. Bk. thin, rusty brown and rough, scaling off in large flakes when old. 78. *Cedrela toona.*

(b) Leaf imparipinnate.
Leaf 4–12 in. long. Leaflets 7-9 in., opposite, ovate, entire, very glossy above, glaucous beneath; fr one celled, 2 valved, 1 seeded loculicidal capsule $\frac{1}{2}$-2/3 in. diam. Seed arillate, not winged. 79. *Heynea trijuga.*

2. Balsamic trees, exuding resin, leaflets not oblique. Fr. a drupe. Leaf 9-15 in. long, crowded at the ends of branches. Leaflets 5-9 pairs, (2–4 in. × 1-$1\frac{1}{2}$ in.), sessile, crenate. Calyx tube short: 5–fid, persistent. Bark 1 in. thick, soft, red inside, exfoliating in large irregular shaped scales. 80. *Garuga gamblei.*

b. *Bipinnate.*
Paripinnate with large leaflets; flat winged pod. Stamens definite, leaflets bright red when young. Pinnae 3–5 pairs, each 1 ft. long, with 5–6 pairs of leaflets. Fls. in dense erect racemes. 81. *Acrocarpus fraxinifolius.*

c. *Palmate.*
§. Leaflets more than 3; petioles very long with sheathing bases, stipules adnate.
(a) Trees. Fls. in axillary compound racemes of white flowers, 1 ft. long on the previous wood. Main petiole 8–12 in.; leaflets 5–10 elliptic accute with undulate margins, glaucous beneath, ns. not conspicuous. Bracts, bracteoles and pedicels rusty pubescent with stellate hairs. 82. *Schefflera racemosa.*

(b) Fls. sessile, bracteoles 4 to each flower; leaflets 6–8, oblong, acuminate, up to 6 in. or even 1 ft. long. Petiole about 6 in., petiolules about 1–2 in. long; flower-umbels in panicles and stout. 83. *Schefflera capitata.*

§§. (a) Serrate ; ns. reddish. Leaflets 3. Petiole short, exstipulate. Leaves 4–12 in. long, very pubescent : leaflets serrate. Petiole 4–5 in., stamens 8, fruit ovoid, red, shining, ¼ in diameter. 84. *Allophylus serrulatus.*

(b) Not serrate ; ns. not reddish. Branchlets and ls. beneath densely ferrugineous-tomentose, leaf acuminate, 3–6 in. long. 85. *Allophylus rheedii.*

Opposite.

Pinnate. (Odd-pinnate).

Stipulate.

Stips. interpetiolar ; leaflets stipellate, young ls. bright yellow.

Ls. 6–18 in. long, drooping, leaflets 3–9, opposite, lanceolate. acuminate coriaceous, serrate, each 2–7 in. by 1–2½ ; Fruit a globose purplish brown drupe, ½–¾ in. diam. with angular shining seeds. 86. *Turpinia nepalensis.*

Exstipulate.

Ls. branches and inf. rusty pubescent, panicles large. Bk. dark brown. Ls. 6-10 in. ; leaflets 9–15, each 3–5 in. by 1–1½ in. lanceolate, entire. Fr. a globose oblique drupe, ¼ in. diam. 87. *Meliosma arnottiana.*

Trifoliate.

Ls. pellucid punctuate. Petioles up to 4 in. long, Leaflets 2–5 in. long. Ns. 10-18.pairs. Seeds black, shining. 88. *Evodia lunar ankenda.*

B. SHRUBS and UNDERSHRUBS.

I. Leaves simple. (125)

1. Alternate. (107)

(1) Thorny. (94)

(i) Stipulate. (91)

Ls. unifoliate, prickly, glaucous below, fasciculate. Fls. trimerous, yellow, in racemes, bisexual; sepals petaloid. Fr. a spindle shaped, red berry with short stout style. 89. *Berberis tinctoria.*

Branchlets ending in spines. Ls. simple, thin, narrow. membranous. Bark: dark grey, smooth, shining, peeling off. Calyx tube urceolate. lobes keeled within. Stamens 4, opposite the petals. Fls. 4 merous, long pedicelled, drupe 1–2 celled. 90. *Rhamnus virgatus.*

(ii) Exstipulate.

Ls. entire.

Prickles only on stem.

Ls. upto 12 × 4 in.; densely white-stellate-tomentose beneath, fls. lilac; Fr. berry, $\frac{1}{4}$–$\frac{1}{3}$ in. glabrous, red. 91. *Solanum giganteum.*

Ls. lobed.

Prickles on stem, Ls. and calyx.

Prickles straight and sharp.

Ls. pinnatifid, upto 8 in. × 4 in. Fls. white or pale blue, berry 1 in. diam; smooth, yellow. 92. *Solanum sysymbrifolium.*

Pickles curved on stems, straight on leaves.

Ls. ovate with shallow triangular lobes; fls. white; berry 1 in diam. globose, green. 93. *Solanum robustum.*

(2) Not thorny.

(i) Ls. Stipulate. (99)

(a) Ls. penninerved. (97)

* Margin serrate.

Ls. closely serrate, ovate oblong, Sec. ns. 6 pairs, prominent. Fls 5-merous, short pedicelled. Drupe 3-celled. 94. *Rhamnus wightii.*

** Margin entire.

i. Ls. less than $\frac{1}{2}$ in.

Ls. $\frac{1}{4}$–$\frac{1}{2}$ in., apiculate, tomentose beneath, white flowered. Fr. scarlet. A rigid much branched shrub. 95. *Cotoneaster buxifolia.*

ii. Ls. more than $\frac{1}{2}$ in.

Ls. membranous, broadly elliptic, obtuse, $\frac{1}{2}$–1 in. long. Fr. $\frac{1}{4}$–$\frac{3}{4}$ in. diam; fleshy, orange, on the lobed saucerlike perianth. A shrub 4 ft. high. 96. *Breynia patens.*

(b) Ls. palminerved.

Slightly aromatic shrub; petiole upto 2 in, Ls. turning red before falling; with 2 glands at base. 2–4 in. × 1–3 in. scabrid above, finely serrate. 97. *Croton lacciferus.*

Not aromatic. Petiole less than 2 in. Ls. with a large gland at base of mid-rib beneath; deeply lobed, and with shallow serrations. Fr. of 5 carpels and covered with hooked bristles. 98. *Urena lobata.*

(ii) Exstipulate.

(a) Calyx adnate to ovary. Fr. a many seeded berry enclosed in the calyx. (101)

* Ls. pellucid punctate, 2–6 in. × $1\frac{1}{4}$–2 in. ovate lanceolate, acuminate, coarsely dentate, petiole $\frac{3}{4}$-1″

fls. white, in long panicles, stamens opposite the corolla lobes. 99. *Maesa perrottetiana.*

** Ls. not pellucid punctate, anthers opening by terminal pores. Ls. 8–14 in. by 3–4 in. ovate lanceolate, long acute. 2 auricled reflexed leaflets resembling stipules at each axil. Fls. blue, in. dense cymose corymbs. Berry $\frac{1}{2}$ in. diam. yellow. 100. *Solanum auriculatum.*

(b) Calyx not adnate to ovary.

* Anthers opening by terminal pores. (104)

Fr. a capsule (not winged):
Corolla urceolate.

i. Leaf serrulate, 2–4 in., faintly aromatic when bruised. Sec. ns. 3–7 pairs. Fr. a loculicidally 5 valved capsule enclosed by the bright blue edible accrescent succulent calyx. 101. *Gaultheria fragrantissima.*

ii. Ls. entire, 3-5 in. by $1\frac{1}{4}$-$1\frac{1}{2}$ in. very coriaceous, clustered at the ends of branches densely covered with a felt of brown hairs, margins recurved, Fls. $1\frac{1}{4}$—2 in. in diameter, dark crimson with large silky bracts. 102. *Rhododendron nilaghirica.*

Fr. a winged capsule; seeds with a 3-fid pendulous caruncle. Fls. zygomorphic, sepals persistent, petaloid. Ls. lanceolate 4-6 in. long. 103. *Polygala arillata.*

** Anthers not opening by terminal pores.

Branchlets angular.

i. Fr. a membranous capsule with 2-3 broad wings. Young shoots viscid. Seeds without a caruncle. Ls. oblanceolate 2-4 in. × $\frac{1}{4}$-$\frac{3}{4}$ in., margin entire revolute. 104. *Dodonea viscosa.*

ii. Young shoots not viscid. Ls. obovate 1–2 in., mucronate, entire. Fr. yellow, one seeded drupe, not winged. 105. *Osyris arborea.*

Branchlets not angled.

Seeds arillate. Fls. in dichotomous cymes, axillary and terminal. Ls. 2–3 in. obovate, crenulate, fr. a capsule $\frac{1}{2}$ in. diam, broadly obovate, 3-celled. 106. *Gymnosporia ovata.*

2. Ls. Opposite.

(1) Thorny.

Ls. 1-$1\frac{1}{3}$ in. coriaceous, elliptic oblong to lanceolate, acute at both ends, veins obscure. Fls. white, tinged with pink, very fragrant. Fr. 1/5 in. ellipsoidal.

A much branched shrub with axillary forked spines. 107. *Carissa paucinervia.*

(2) Not thorny.

Stipulate (117)

Stipules interpetiolar (114)

i. Climbing shrubs.

Calyx with one lobe forming a white coloured leaf. Fls. orange, in terminal cymes. 108. *Mussaenda hirsutissima.*

ii. Erect shrubs.

* Stems 4 angled.

Stips. brizzling, connate with the petiole into a sheeth. Ls. twice as long as broad; blade $1\frac{1}{4}$–$2\frac{1}{2}$ in. × $\frac{1}{2}$–$1\frac{1}{4}$ in., ovate lanceolate, many veined. 109. *Knoxia mollis.*

** Stem nearly round.

(a) Fr. a berry.
Stem slightly swollen at the nodes. Stips. forming a complete sheath above the insertions of the ls. Ls. 4 in. × 2 in. hard, glossy, with impressed main Ns. Ns. about 10 pairs with perforations at the nerve axils. Anthers exserted.
Fls. white, fragrant in terminal cymose corymbs. Young parts often resinous. 110. *Chomelio asiatica, O. Kze.*

(b) Fr. a capsule.
Stips not sheathing, bi-fid, caducous. Bracts sub persistent. Ls. elliptic ovate, membranous, narrowed to the slender petiole; petiole 1 in. Fls. in terminal forking cymes. Fr. a capsule of 2 compressed lobes. 111. *Ophiorrhiza brunonis.*

(c) Fr. a drupe of 4-9 pyrenes. Ls. evil smelling when crushed, bifarious. Fls. foetid. Corolla hairy at the throat.

(i) Ls. 2–3 in., narrow, ovate. Fls. yellowish. 112. *Lasianthus venulosus.*

(ii) Young parts hirsute with purplish hairs. Ls. oblong lanceolate, Ns. 6 pairs. Fls. purple. 113. *L. ciliatus.*

II. Stipules intrapetiolar.

* Ls. pitted at nerve axils, whorled. Branches of inflorescence all whorled. Ns. of ls. strong and parallel.

(i) Bark light brown, smooth. Ls. obovate upto 5 in. × 1½ in. cuneate at base, rounded and then acute at apex. Ns. 8–12 pairs. Cymes of fls. congested. 114. *Psychotria congesta.*

(ii) Bark light brown, corky. Ls. ob-lanceolate 2–5 in. × 1–2 in ; Ns. 9 pairs Cymes terminal. 115. *Psychotria bisulcata.*

** Ls. not pitted at nerve axils, not whorled. Stips connate into a deciduous sheath, nodes marked by the scars of petioles. Ls. elliptic, 3–5 in. by 1¼–1½ in. Ns. 6 pairs distinctly raised on the underside, dotted with large glands. 116. *Pavetta breviflora.*

Exstipulate.

(i) Juice milky.

Ls. obovate, to oblanceolate, 4 in. × 2 in. Ns. 8–16 pairs. Fls. in bifurcating corymbose cymes. Fr. of 2 distinct carpels of one seeded drupe. 117. *Rauwolfia densiflora.*

(ii) Juice not milky.

* Ls. palminerved. (3-5 ribbed)

1. Calyx tube adnate to ovary and not produced beyond it. Ls. tomentose, 2 in. × 1–1½, ovate stamens indefinite, fr. 3–6 celled. Many seeded berry. 118. *Rhodomyrtus tomentosa.*

2. Calyx tube adnate to ovary but produced beyond it. Branches square, thinly covered with erect hairs. Ls. ovate, lanceolate, 3-ribbed. Cymes dense, terminal, petals $\frac{1}{2}$ in. pink. 119. *Osbeckia rosea.* Fyson.

** Ls. penninerved.

(a) Ls. gland dotted.

Glands black, translucent. Leaves stiffly decussate. Twigs 4 angled. Fr. a septicidal capsule; rich crimson in colour. Style exceeding ovary in length. 120. *Hypericum mysorense.*

(b) Ls. not gland dotted.

§ Leaves entire—(124)

i. Fls. in heads.

Yellow, ls. subsessile, 2–3 in. long. Fls. in terminal, white silky or buff coloured heads, supported by silky involucral bracts. 121. *Lasiosiphon eriocephalus.*

ii. Fls. in terminal panicles.

Fls. creamy white, in peduncled pairs. Stem twisted; bark light brown, papery. Ls. lanceolate upto 2 in. long. Berries combined, the pair enclosed in a bract. 122. *Lonicera ligustrina.*

iii. Fls. in 1–3 flowered cymes. Ls. ovate, elliptic, shining coriaceous, ns. prominent. Fls. white, sweet-smelling, corolla tube 1 in. long, lobes ·7 in. acute. 123. *Jasminum rigidum.*

§§ Ls. serrate.

Ls. about 12 in. × 6 in., corolla blue to white in a long cylindrical thyrsis, stamens exserted. Fr. a 4-lobed purple drupe. 124. *Clerodendron serratum.*

Ls. Compound.

Alternate.

Pinnate.

Imparipinnate. (127)

Spinescent.

Leaflets 5–25 pairs, spinous, 1–5 in. long. Berries glaucous purple. Bark corky. 125. *Mahonia leschenautii.*

Not spinescent.

Leaflet 3–5 pairs, coarsely serrate, 1–3½ in. by ½ to 1½ in. Fr. a scarlet, 5 furrowed juicy drupe, ¼ in. diam., with angular seeds. 126. *Cipadessa baccifera, Miq.*

Paripinnate.

Ls. with subulate glands between leaflets :

Leaflets 3–5 pair, lanceolate, acuminate, glabrous. Fls., large, yellow, in corymbs. Pods cylindric, turgid, upto 3 in- 127. *Cassia laevigata,* Leaflets 6-8 pair, oblong, obtuse densely tomentose beneath. Fls. yellow, in corymbose racemes ; pods flattened, upto 5 in. long, pubesecnt. 128. *C. tomentosa.*

Ls. with sessile glands on petiole : Midrib nearer the upper than the lower margin of the subfalcate leaflet:

Ls. usually 3–4 in. long, leaflets 40–60 pairs. Pod 1–2 in, long. 16–*25* seeded. Fls. yellow. A diffuse undershrub. 129. *Cassia mimosoides.*

Ls. usually 1–2 in. long. Leaflets 16-24 pairs. Pod 1-2 in.; 8–15 seeded. A suberect undershrub. 131. *Cassia lesehenaultiana.*

Ls. bipinnate. (abruptly).

Armed ; Pinnae 5–10 pairs : leaflets 8-10 pairs, 0·5 to 0·7 in. long. Fls. bright yellow. Pod oblong, beaked, 3–4 in. by 1 in., 6–8 seeded. 131. *Caesalpinia sepiaria.*

C. CLIMBERS.

1. Ls. simple. (150).

i. Alternate. (143).

(1) Tendril climbers. (135).

x. Tendrils axillary; stamens and styles raised on a central column. Ls. glandular at base, or above petiole.

Ls. entire, half-moon shaped; stipules slender. 132. *Passiflora leschenaultii.*

Ls. 3–lobed ; stips. large, leafy $\frac{3}{4}$–1 in. × $1\frac{1}{2}$ in. 133. *Passiflora calcarata.*

xx. Tendrils extra-axillary; anthers syngenesious. Stem and ls. densely villous, Ls. 6–7 lobed with shallow sinuses and subulate teeth. 134. *Trichosanthes villosula.*

(2) No tendrils.

x. Ls. palminerved. (138).

* Ls. peltate.

Ls. broadly ovate or triangular $1\frac{1}{4} \times 1\frac{1}{2}$ in.; heads of fls. in stalked umbels. Fr. a red drupe $\frac{1}{4}$ in.; stone horse-shoe shaped with tubercled ridges. 135. *Stephania japonica.*

** Ls. not peltate; basal nerved.

Spinescent.

Stem with solitary recurved prickles. Ls. 2–4 in., elliptic, densely tomentose below. Fr. a drupe with a hard stone. Not edible. 136. *Zizyphus rugosa.*

Not spinescent.

Plants climbing by adventitious roots from swollen nodes. Ls. ovate elliptic. dark green and glossy above, pale white below. Berries red or yellow. 137. *Piper schmidtii.*

xx. Ls. penninerved.

* Spinescent.

Straight long spiny branches. Ls. ovate oblong with shining silvery scales below. Fr. linear oblong $\frac{3}{4}$–$1\frac{1}{2}$ in. with 8 ribs, red, fleshy with acid taste. 138. *Elaeagnus kologa.*

** Not spinescent.

a. Ls. pellucid punctate.

Ls. glossy, elliptic lanceolate, punctate at the nerve axils, 2–3 in. × 1 in. Fls. white; fl.-branches drooping; fr. globose 1/6 in. 139. *Embelia ribes.*

Ls. elliptic-obovate, narrowed at base, upto 4 in. × 1.5 in. Fls. orange coloured, from the older branches. 140. *Embelia basaal.*

b. Ls. not pellucid-punctate.

Seeds arillate.

Ls. broadly elliptic, or orbicular cuspidate, finely crenate, in the upper half, usually entire near base, 2½-4 in. Fr. size of a pea, bright orange: seeds embedded in a scarlet aril. 141. *Celastrus paniculata,*

Seeds not arillate.

Nodes swollen. Stips. ochreaceous. Ls. 3-5″ ovate-oblong, acuminate, finely serrate, with two ear-like expansions at base of pet.; Fls. pink; fl-heads in terminal panicles. 142. *Polygonum chinense.*

ii. Ls. opposite.

(1) Juice milky:

x. Ls. broadly elliptic, or ovate, shortly acuminate 3×2 in., *stalk, midrib, and nerves purple.* Follicle 2½–3 in. black. 143. *Brachylepis nervosa.*

xx. Ls. cordate.

Fls. yellowish; follicles 1½ in. slender, glabrous. Ls. 1½–2½ in., ovate acute cuspidate, tawny tomentose. 144. *Gymnema hirsuta.*

Fls. green; follicles 3–2 in. × 1–1½ in., black, smooth. Ls. 3—6 in., broadly cordate acuminate with small glands just above petiole. 145. *Marsdenia vollubilis.*

(2) Juice not milky:

Fls. bracteate:—

x. Bracts at the base of pedicels leaf-like; bracteoles large, enclosing fls. Fr. a loculicidal capsule; Ls. ovate or ovate lanceolate, cordate to hastate with spreading auricles; capsule villous. 146. *Thunbergia tomentosa.*

xx. Bracts linear and small, bracteoles linear. Fr. a 2-lobed berry. Stamens 2. Ls. large, ovate or ovate-lanceolate, long acuminate, subcordate, glabrous, upto 6 in. × 3 in. prominently nerved from near base. 147. *Jasminum cordifolium.*

xxx. Bracteoles 2. Fr. a fleshy 2–3 celled berry, in pairs of two. Ls. joined by a scar. Ls. ovate-acuminate, densely grey tomentose; upto 3 in. 148. *Lonicera leschenaultii.*

Fls. not bracteate:—
Petioles connected by a stipular line. Stem spirally twisting. Ls. elliptic acute, 2 to 5 in. long; fls. yellow, in trichotomous cymes, berry scarlet. 149. *Gardneria ovata, Wall.*

2. Ls. compound.

i. Ls. alternate. (154)

(1) Prickly climbers. (153)

x. 3-foliate.
Leaflets 1-4 in. rounded or pointed, white tomentose beneath. Prickles on the midrib. Fr. yellow, luscious, with flavour. 150. *Rubus ellipticus.*

xx. Imparipinnate.

(i) Ls. of 5–7 leaflets; leaf from 4 in.; including stalk 8 in. Fls. white, Fr. stalks recurved. 151. *Rubus racemosus.*

(ii) Leaflets 5, glabrous, obovate, oblong acute, finely serrate, Fls. white, 2–3 in. diameter. 152. *Rosa leschenaultii.*

(2) Non-prickly.
Tendril climber. Ls. pedately compd. Leaflets ovate-lanceolate. 153. *Gymnostemma pedata.*

ii. Ls. opposite.

x. Ls. 3–foliate.

* Thorny.

Thorns recurved. Ls. coriaceous, sessile, elliptic oblong, apex notched, glabrous, pellucid-punctate, 1½–3½ in. Fls. white; Fr. globose, orange. 154. *Toddalia asiatica.*

** Not thorny.

£ Climbing by leafstalks Leaflets 3, ovate acute; fls. 3; fr. an achene with long feathery tails 155. *Clematis munroana.*

££ Climbing by stem.
Lateral leaflets smaller than terminal. Stem spirally twisted. Fls. white, fragrant. 156. *Jasminum brevilobum.*

xx. Ls. more than 3–foliate.

* Thorny.

Leaflets 3–5, pellucid punctate, carpels with one black seed. 157. *Xanthoxylum tetraspermum.*

** Not thorny.

£ Climbing with petiole.
Ls. pubescent, leaflets 3-5 lobed, coarsely dentate, veins thick, prominent, Fls. over 2 in. diameter, yellow. 158. *Clematis wightiana,*

££ Climbing by the stem.
Leaflets 3–5,; Fls. bell-shaped, orange. 159. *Jasminum bignoniaceum.*

3. Ls. bi-compound.

x. Ls. alternate. Branches covered with grey tomentum, Ls. 9-12 in. of 12–20 pinnae, green above, glaucous below, Fls. pale yellow. Pod boat-like with 6 brown-grey mottled seeds. 160. *Caesalpinia sepiaria.*

List of trees, shrubs, and woody climbers in the Key :—

[T = Large tree. t = Small tree. SH. = Large shrub. sh = Small shrub. Str. = Straggling. Cl. = Climber. Names in italics are *Badaga* names.]

1	Acrocarpus fraxinifolius, Wt. (T) Shingle tree, Pink cedar. *Kalingi.* Fl. Feb. ...	Caesalpinieae.
2	Acronychia laurifolia, Bl. (t) ...	Rutaceae.
3	Actinodaphne lawsonii, Gamble. (t) ...	Lauraceae.
4	Allophyllus serrulatus, Radlk. (t) ...	Sapindaceae.
5	,, rheedii, Radlk. (t) ...	Do.
6	Antidesma menasu, Miq. (t) ...	Euphorbiaceae.
✓ 7	Berberis tinctoria, Lesch. (sh) ...	Berberidaceae.
8	Brachylepis nervosa, W. & A. ; (Cl) ...	Asclepiadaceae.
9	Breynia patens, Benth. (sh) ...	Euphorbiaceae.
10	Caesalpinia sepiaria, Roxb. (Str. SH) The Mysore Thorn. *Chillar* ...	Caesalpineae.
11	Carissa paucinerva, A. DC. (SH) ...	Apocynaceae.
12	Casearia coriaceae, (t) Vella Kunnan (Mal) ...	Samydaceae.
13	Cassia laevigata, Willd. ...	Caesalpinaceae.
14	Cassia leschenaultiana, DC. (str. sh) ...	Do.
15	Cassia mimosoides, Linn. (sh) ...	Do.
16	Cassia tomentosa, Linn. (SH) ...	Do.
17	Cedrela toona, Roxb. (T) Red cedar. *Kalkilingi* ...	Meliaceae.
18	Celastrus paniculata, Willd. (Cl) ...	Celastraceae.
19	Celtis tetrandra, Roxb. Nettle-tree (T) ...	Ulmaceae.
20	Celtis wightii, Planch. (T) *Hadawa* ...	Do.
21	Chomelia asiatica, O. Kze. (Sh) ...	Rubiaceae.
22	Cinchona ledgeriana, (t) "Yellow bark" ...	Do.
✓ 23	Cinnamomum wightii, Meissn. (T) Cinnamon. *Aduva*, Fl. May ...	Lauraceae.
24	Cipadessa baccifera, Miq. (sh) ...	Meliaceae.
25	Clematis munroana, Wt. (Cl) ...	Ranunculaceae.
26	Clematis wightiana, Wall. (Cl) ...	Do.
27	Coleus barbatus, Benth. (sh) Flame-Nettle.	Labiateae.
28	Clerodendron serratum, Spreng. (sh) ...	Verbenaceae.
29	Cotoneaster buxifolia, Wall. (sh) *Hurane.*	Rosaceae
30	Croton lacciferus, L. (sh) ...	Euphorbiaceae.
✓ 31	Daphniphyllum glaucescens, Bl. (t) *Nirkakke*	Do,
✓ 32	Dodonea viscosa, Linn. (SH) *Vilari* ...	Sapindaceae,
33	Elaeocarpus ferrugineus, Wight (T) ...	Tiliaceae.
✓ 34	Elaeocarpus munroii, Mast. (T) *Mare bikki.*	Tiliaceae.
35	,, oblongus, Gaert. (T) *Bikki* ...	Do.
✓ 36	Elaeagnus kologa, Sc. (str. SH) "Kollanga"...	Elaeagnaceae.

37 Embelia ribes, Burn. (Cl) ... Myrsinaceae.
38 „ basaal, A. DC, (Cl) ... Do.
39 Euonymus crenulatus, Wall, (t). The spindle tree ... Celastraceae.
40 Euonymus indicus, Heyne. (t) ... Do.
✓ 41 Eurya japonica, Th. (SH) *Hodoni* ... Ternstroemiaceae.
42 Evodia lunur-ankenda, Merr. (t) ... Rutaceae.
43 Excoecaria crenulata, Wt. (t) ... Euphorbiaceae.
44 Fagraea obovata, Wall (t) ... Loganiaceae.
45 Ficus tseila, Roxb. (T) ... Moraceae.
46 Garcinia cambogia, Desr. *Heeli* ... Guttiferae.
47 „ cowa, Roxb. ... Do.
48 Gardneria ovata, Wallich. (Cl) ... Loganiaceae.
49 Gaultheria fragrantissima, Wallich. (sh) ... Ericaceae.
50 Girardinia heterophylla, Dcne (t) ... Urticaceae.
51 Glochidion neilgherrense, Wight *Hanake*. (t) ... Euphorbiaceae.
52 Glochidion velutinum, Wight (t) ... Do.
53 Gomphandra coriacea, Wt. (t) ... Icacineae.
54 Gordonia obtusa, Wall (t) *Nagetta* ... Ternstroemiaceae.
55 Gymnosporia ovata, Lawson. (sh) ... Celastraceae.
56 Gymnema hirsutum, Wt. & Arno. (cl) ... Asclepiadaceae.
57 Gymnostemma pedata, Blume (cl) ... Cucurbitaceae.
58 Heynea trijuga, Rox. (t) ... Meliaceae
59 Hypericum mysorense, Heyne. (sh) ... Hypercineae.
60 Hydnocarpus alpina Wt. (t) *Maratatti* ... Bixineae.
61 Ilex denticulata, Wall. (T) *Tude* ... Aquifoliaceae.
62 Isonandra candolleana, Wt. (t) ... Sapotaceae.
✓ 63 Ixora notoniana, Wallich. (Cl) ... Rubiaceae.
64 Jasminum cordifolium, Wall. (Cl) ... Oleaceae.
65 „ rigidum, Zenk. (sh) ... Do.
66 „ breviolobum, DC. (Cl) ... Do.
67 „ bignoniaceum, Wall. (Cl) ... Do.
✓ 68 Knoxia wightiana, Wall. (sh) ... Rubiaceae.
69 Lasianthus venulosus, Wt. (sh) ... Rubiaceae
70 „ ciliatus, Wt. (sh) ... Do.
71 Lasiosiphon eriocephalus, Dec. (sh) Vandakollipatti (tam) ... Thymelaceae.
✓ 72 Ligustrum perrotetti, DC. (SH) *Koli* ... Oleaceae.
73 „ roxburghii, C. B. Clarke. (t). ... Do.
74 Litsea floribunda, (t) ... Lauraceae.
75 „ ligustrina, Nees. (t) ... Do.
✓ 76 „ Wightiana, Wall. (T) *Kenji* ... Do.
77 Lonicera leschenaultii, Wall. (Cl) ... Caprifoliaceae.
78 „ ligustrina, Wall. (sh) ... Do.
79 Macaranga indica, Wt. (T) ... Euphorbiaceae.

✓ 80	Machilus macrantha, Nees. (T) *Kruramavu*	Lauraceae.
81	Maesa perrottetiana, DC, (st. sh).	Myrsinaceae.
✓ 82	Mahonia leschenaultii, Takeda. (SH) the Holly leaf Barberry. *Tarikallu*	Berberidaceae.
83	Mallotus philippinensis (t) Muel.	Euphorbiaceae.
84	Mappia foetida, Miers. (t) *Kadalmuki*	Icacinaceae.
85	Marsdenia volubilis, T. Cooke; (str. Cl)	Asclepiadaceae.
86	Melicope indica, Wt. F. B. I. (SH) or (t)	Rutaceae.
87	Meliosma arnottiana, Wight. (T) *Bilemukki*	Sabiaceae.
88	,, simplicifolia, (t)	Do.
89	,, wightii, Planch. (T) Spirae tree *Tode.*	Do.
90	Memecylon lushingtonii. Gamble. (t)	Melastomaceae.
91	,, malabaricum. Cogn. (t)	Do.
✓ 92	Michelia nilagirica, Zenk (T) Neilgherry champak. *Sampage.*	Magnoliaceae.
93	Microtropis ovalifoila, Wight. (t)	Celastraceae.
94	,, ramiflora, Wight. (t)	Do.
95	Mussaenda hirsutissima, Hutch (St. Sh)	Rubiaceae.
96	Neolitsea zeylanica, Merrill (t) *Bellure*	Lauraceae.
97	Nothopegia colebrookiana, Bl. (t)	Anacardiaceae.
98	Olea glandulifera, Wall. (T).	Oleaceae.
99	Osyris arborea, Wall. (sh) *Babbayakku*	Santalaceae.
100	Osbeckia rosea. Fyson. (sh)	Melastomaceae.
101	,, wightiana, Benth. (sh)	Do.
102	Ophiorhiza brunonis, W. & A. (sh)	Rubiacaae.
103	Passiflora leschenaultii, Dc. (Cl)	Passifloraceae.
104	,, calcararata (Cl) *Covayonkou*	Do.
105	Pavetta breviflora, DC. (sh)	Rubiaceae.
106	Phoebe wightii, Meissn. (t) *Kumara*	Lauraceae.
107	Photinia lindleyana, W. & A. (T) *Hoineri*	Rosaceae.
✓ 108	,, notoniana, W. & A. (T) *Kodabikki*	Do.
✓ 109	Piper schmidtii. Hook. (Cl)	Piperaceae.
110	Pittosporum tetraspermum, W. & A. (t) Cherry orange. *Kuhimavu*	Pittosporaceae.
111	Pittosporum teraspermum, W. & T. (T),	Do.
112	Plectronia didyma, Kew, (t)	Rubiaceae.
113	,, neelgherrensis. Bedd. (t)	Do.
114	Polygala arillata, Ham. (sh) Red eye or Yellow milk wort. Nilgherry Milk wort.	Polygonaceae.
115	Polygonum chinense, Linn. (Cl)	Polygonaceae.
116	Psychotria elongata, Wt. (sh)	Rubiaceae.
117	,, bisulcata, W. & A. (sh)	Do.
118	Pygeum gardnerii, Hook. (T)	Rosaceae.
119	,, wightianum (T)	Do.
✓ 120	Rapanea wightiana, Wall. (t) *Kokkeli*	Myrsinaceae.

121 Rauwolfia densiflora, Benth. (sh.) ... Apocynaceae.
122 Rhamnus virgatus, Rox. (sh) Buckthorn... Rhamnaceae.
123 Rhamnus wightii, W. & A. (SH) ... Do.
✓ 124 Rhodomyrtus tomentosa, Wight (sh)
Tavuttu-Koyya ... Myrtaceae.
✓ 125 Rhododendron nilgiricum, Zenk. (SH)
Billi ... Ericaceae.
126 Rosa leschenaultiana, W. & A. (Cl)
The Nilgiri Dog Rose ... Rosaceae.
✓ 127 Rubus ellipticus, Smith. Yellow bramble. (Cl) Do.
128 „ racemosus, Roxb. (C.) ... Do.
129 Salix tetrasperma, Rox. (T) *Bayike* ... Salicacaeae.
130 Schefflera racemosa, Harms. (T) ... Araliaceae.
131 Senecio walkerii, Arn. (Cl) ... Compositae.
132 Scolopia crenata, Clos. (T) Potato plum
of Mysore. *Charalu* (tam); *Heccaralu* ... Bixaceae.
✓ 133 Sideroxylon tomentosum, Roxb; (t) *Hale* ... Sapotaceae.
134 Solanum auriculatum, Ait. (Sh) ... Solanaceae.
135 „ giganteum, jacq. (SH) ... Do.
136 „ robustum, Wendt. (sh) ... Do.
137 „ sissymbrifolium, Lamk. (sh) ... Do.
138 Stephania japonica, (Cl) ... Menispermaceac.
✓ 139 Symplocos spicata ... Symplocaceae.
✓ 140 Syzygium arnottianum, Wight. (T) Nage ... Myrtaceae.
141 „ callophyllifolium, Walp. (T) ... Do.
142 „ jambolanum, DC, (T) *Nerale* ... Do.
143 „ montanum, Gamble, (T) *Punage*... Do.
144 Ternstroemia japonica. Th. (T) *Kemuni* : Ternstroemiaceæ.
145 Thunbergia tomentesa. Wall. (Cl) ... Acanthaceae.
✓ 146 Toddalia asiatica, Lamk. The Toddali. (str. sh.) : Rutaceae.
147 Trema orientalis, Bl. (T) Charcoal Tree. *Home* :: Ulmaceae.
448 Trichosanthes villosula, Cogn. CL) ... Cucurbitaceae.
149 Triumfetta pllosa, Roth. (sh) ... Tiliaceae.
150 Turpinia nepalensis, Wall. (t) *Nila* ... Staphyleaceae.
151 Urena lobata, Linn. (sh) ... Malvaceae.
152 Vaccinum leschenaultii, Wight, (T) *Kila* : Vaccinaceae.
153 „ nilgherrense Wight. (t) ... Do.
154 Vernonia monosis, Benth. (T) ... Compositeae.
155 Viburnum acuminatum, DC (t) *Helesunde* : Caprifoliaceae.
156 „ hebanthum, W. & A. (T) *Kadambu* Do.
157 „ erubescens, Wall (t) Do.
158 Wendlandia notoniana, Wall. (t) *Thintthilu* ... Rubiaceae.
159 Xanthoxylum tetraspermum, W. & A, (Cl) ... Rutaceae.
160 Zizyphus rugosa, Lamk. (Cl) ... Rhamnaceae.

EXTRACTS.

1. Inauguration of the Mettur Dam and Reservoir :

The development of irrigation in India has taken another notable step forward with the recent completion of the Mettur Dam in the province of Madras, and the occasion of the official opening on August 21 was marked by an impressive ceremony when Sir George Stanley, the Governor of Madras, made the electrical contact which operated the sluice penstocks and released a huge volume of water from the impounded area. The dam and reservoir, which are to take the designation " Stanley ", are located on the Cauvery River, 100 miles north-west of Trichinopoly and 180 miles south-west of Madras. The dam, one of the most massive structures of its kind in the world, contains 1,852,000 cubic yards of masonry weighing 3,2000,000 tons; it has an over-all length of 5,300 ft., and a height of 176 ft. The reservoir will extend more than 40 miles north of the river, with a circumference of about 100 miles, and will have a capacity of 90,000,000,000 cub. ft. The catchment area is 15,700 square miles in extent and the total area to be irrigated will be rather more than 1,300,000 acres, including some 300,000 acres at present without any form of irrigation. Pipes have been built into the dam to permit of the utilisation of some of the water for the generation of hydro-electric power in a scheme which is now under consideration by the Secretary of State. The cost of the Cauvery-Mettur undertaking is given as about 5½ million sterling. The idea was conceived about a century ago by Sir Arthur Cotton, but work was not begun until 1925 and benefited by the experience gained during the unprecedented floods of the previous year, which caused a revision and extensien of the scheme. For his services in connexion with the work, Mr. Clement T. Mullings, who was chief engineer of the project from 1927 until 1931, has received the honour of knighthood.

— *Nature, 1–9–34.*

2. A Beautiful Wooden Casket :

On the occasion of the visit of Their Excellencies Lord and Lady Willingdon to the Anamallais Timber Trust Limited at Chalakudi (Cochin State), on 7th December 1933, a beautiful casket was presented to Their Excellencies by the Directors of the Trust. In order that the casket might furnish an appropriate momento of the Industry followed by its donors, it was made of woods from their forest and was fashioned entirely by

Cochin workmen. Its shape is octagonal and the eight panels are filled with ivory etchings. The top of the casket is occupied by a group of elephants carved in ebony, two of them suspend from their upraised trunks, an ivory scroll recording the occasion of the presentation, with the titles of Their Excellencies and names of the Directors of the Trust. Below the scroll are ivory medallion portraits of Lord and Lady Willingdon from recent photographs; in front two ebony elephants transport a teak log exactly as is done in the forest. The drivers have the pointed cap and long goad peculiar to South India.

The same Trust made another presentation to Her Excellency the Countess of Willingdon of what is claimed to be the largest single * plank dining table in the world, which at Her Excellency's suggestion has been accommodated in Belvedere, Their Excellencies' residence in Calcutta.

— *The Indian Forester, Sep. 1934.*

3. Forest Biology :

In his presidential address to Section K (Botany), Prof. A. W. Borthwick discusses "Some Aspects of Forest Biology". The present-day endeavour to grow pure forests involves many problems demanding scientific forest management, with the aim of obtaining the highest yield in the shortest time. In this, the inseparable connexion between botany and forestry becomes all-important.

The climatic factor has an important bearing on forestry. The optimum region where the general balance in climatic factors is the most favourable usually produces the most desirable results with a minimum of trouble and cost. The question of acclimatisation is far from settled, though it is of the utmost importance. Reaction to light intensities and edaphic factors, too, form an important study Though the tree may react temporarily to certain changes in conditioning factors, there is no evidence that such reaction becomes permanent and hereditary.

In forestry, the long period which must elapse between the establishment of a crop and its final harvesting makes it imperative that a judicious choice of trees best adapted to any given locality be made. Here again, the forester comes into close contact with the botanist. The structure of trees, their reaction to conditioning factors, and, above all, their individual

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* We understand the plank was of Rosewood and about 16 ft. by 8 ft. !—*Ed.*

variability must all be taken into consideration during afforestation.

The fundamental biological facts of sylviculture may be grouped according to the three stages of the life of a forest; juvenile, pole or stage of most rapid height growth and adult stage. In the juvenile stage, clearing and weeding must not be delayed. Thinning out, too is important. The pole stage is the time of greatest density in the life of the stand. Here the skill of the forester is put to the test, for now is the time to encourage length, form and cleanness of stem. In the adult stage, work should be diverted into obtaining the greatest volume production and quality of timber by controlling diameter increment.

The biology of the large pure stands of timber naturally differs from that of mixed stands. The arrangement of the different species in a mixed stand is a difficult problem. It would seem that the suggestion of Prof. Helnrich Mayer that the forest should be made up of small compartments, each compartment consisting of one species, satisfies most of the requirements of the trees.

Other aspects of the forest as a living community which have not received much attention yet are its biological influences, especially on drainage and water supplies; and its effect on winds in breaking and tempering them. This latter involves the question of a reasonable balance between forest and grazing land, which is one of considerable biological and economic importance.

— *Nature*, *8–9–34*.

4. Before Papyrus : Beyond Rayon :

Rayon a few years ago was universally known as artificial silk. The basic chemical substance to which the writer refers is cellulose. It forms the structural framework of all vegetable life and is the raw material of great industries. The reason why the derivatives of cellulose were so low in developing is that it is only a few years ago since its empirical composition was discovered. Transparent sheets of cellulose plastic are used in the manufacture of the laminated 'glass' used in automobiles. A recent discovery has so lowered the cost of the manufacture of cellulose acetate plastic that at the present time more than 70 per cent of all the laminated 'glass' manufactured in the United States is made from it. They also make bullet-proof 'glass' composed of five laminations, the centre one being a piece of plate glass about $\frac{3}{4}$ in. in thickness. It is being used for the windows of armoured cars and cashiers' cages in banks. In 1910, no rayon was being made in the United States. In 1931, 144 million pounds were produced. Methods of manufacturing rayon are continually improving, greatly increasing its strength and its resistance to water. A new use of cellulose is the manufacture of shoes. With this material all sewing and nailing of the soles to the uppers are eliminated. The cement used to stick them together is a cellulose nitrate cement. It is now only necessary to hold them together for fifty seconds. A single operator in 8 hours 15 minutes applied soles to 1,580 pairs of shoes. The value of cellulose as a raw material is continually increasing as our knowledge increases.

— *Nature*, *25–8–34.*

5. Experiments with Falkamesam Preservative:

By A. V. Varadaraja Iyengar, M.Sc., A.I.C.

Department of Biochemistry, Indian Institute of Science, Bangalore.

The discovery of the Falkamesam Process marks an important stage in the development of wood preservatives. Apart from other considerations such as cost, etc., the advantage lies in the fixation of arsenic in the wood, from which the material cannot be easily removed. Moreover, the employment of simple leaching experiments to test such fixation is a technique, easy of test in the laboratory in place of the normal practice of testing through lapse of time and exposure to diverse weather conditions.

A detailed test of the process was undertaken at this Institute at the suggestion of Sir C. V. Raman. To this end, the method described by Popham and Kamesam (*Indian Forester*, 1932, 58, 191) was closely followed. The wooden pieces were impregnated at 150 lbs. pressure for 5 hours in arsenic solution fixed according to the above process, in arsenic of the same concentration without the preservative, and in distilled water, the last two serving as controls for the first.

It was found that the loss in weight is least when the fixative is employed. Moreover, the pieces turn distinctly green after drying.

Treatment of wood with Falkamesam fixative serves better to fix arsenic and does not leach it out to any appreciable extent on shaking with water. It would be of interest to determine the mechanism of arsenic fixation in the above process.

— *The Indian Forester*, *Sep. 1934.*

6. Australian Sandalwood:

Considerable improvement has been shown in the position of the sandalwood industry since the introduction, in July, 1932, of single unit control over the export of all sandalwood from Western Australia and South Australia. Excess stocks of West Australian wood, which two years ago amounted to approximately 7,000 tons, have now been reduced to 3,500 tons, and, in addition to the liquidation of stocks, it has been possible to place orders regularly for new wood. Under the agreement with South Australia the export of sandalwood from the two States is regulated by actual sales in China, and of the total quantity shipped, two-thirds is from this State, one-half of which goes in reduction of accumulated stocks and one-half is placed for new pulling.

Although the total exports during the last four or five years have been much lower than in the years immediately following the war, this is believed to be attributable to loss of purchasing power of the masses in the interior of China following civil wars, abnormal floods and the fall in the value of export commodities.

The practice followed during previous years of submitting all applications for sandalwood orders to an advisory board, on which the prospectors and sandalwood getters are represented, has been continued. Two hundred and eighteen orders for 1,420 tons of export wood were placed during the year on the Goldfields areas, and thirteen orders for 125 tons of sandalwood for distillation were issued in the Carnarvon and North-West districts. Assistance was also given to the holders of a number of Conditional Purchase Leases, on which the sandalwood had been reserved to the Crown, by placing orders with them for sandalwood pulled during the process of clearing operations.

The quantity of sandal supplied from all sources during the year ended 30th June, 1934, is set out in the following table:—

Locality.	Distillers.	Export.
	tons.	tons.
From Crown Lands, South of 26th parallel.	272	996
From Crown Lands, North of 26th parallel.	39	...
From Private Property	...	74
Totals ...	311	1,070

The Department was asked to inspect and assess the value of 384 tons of the wood supplied, which was considered to be below fair average quality, and reductions in the price to be paid for this wood, ranging from 2s. 6d. to 90s. per ton, were authorised. After taking these reductions into account, the average price paid to the getter for sandalwood logs was £15 12s 10d. per ton f.o.r. Fremantle.

The quantity of sandalwood to be obtained from private property is limited under the "Sandalwood Act, 1929," to 10 per cent. of the total quantity to be pulled annually for export. During the year twenty-nine licenses were issued for the pulling and removal of 112 tons of wood.

Owing to the general trade depression and the accumulation of large stocks, the distillation works were closed for the greater part of the year and only 311 tons of sandalwood were purchased for distillation purposes.

Two thousand five hundred and eight tons of sandalwood, valued at £75,424, were exported during the year.

The quantity of sandalwood oil exported amounted to 17,700 ℔s., being 2,500 ℔s. less than for the previous year.

— Report on the operations of the Forest Department, Western Australia for the year ended 30–6–34.

7. Mysore Cardamon Estates—near Kusli, (Travancore).

Note by Md. Abdul Hafiz, B.A., M.F.S., Assistant Forest Utilization Officer, Madras.

Nursery. Nurseries are formed near streams or wells. Fresh mature seeds are used for sowing. From fully ripe capsules gathered from healthy and selected plants, seeds are taken out and mixed lightly with ash and spread out to dry in shade for a couple of days. These are used for sowing in beds for a fortnight. Storing seeds for a longer period is said not to give good results. One Madras measure is said to contain 75 to 80 thousand seeds and will give approximately 40 to 50 thousand good seedlings. Seed-beds are usually 25 to 30 feet long, 3 to 4 feet wide. 6″ to 9″ high. It takes 3 coolies (Rs. 1–2–0) to make a good bed of the above size. The soil is turned over several times and broken up fine. 1/6 Madras measure of seeds is sown in each of such seed beds. Time of sowing is from February to April. Seeds are strewn by hand on the top of prepared beds and covered lightly with soft earth thrown by hand. The beds are then covered on top with long grass which is fixed on the beds. This is done to prevent the seeds from being washed or disturbed while watering with a can fitted with a fine spray. Beds are watered twice a day, morning and evening for the first 10 days and then once a day for the next 10 days, then again twice a day for 20 days. Seeds germinate in 40 to 45 days. When the cotyledons appear, shade is erected on the beds and grass is removed with great care from top of beds. Top shade is about 4 feet high and should slant slightly to drain away rain water. Watering is done twice a day till 2 leaves appear in another 30 days time, and afterwards once a week.

Transplanting. Seedlings attain a height of 6 inches in 3 to 4 months i. e. by June, when they are transplanted to other beds in or near the nursery, 9 to 12 inches apart. Transplanting is usually done after the monsoon has set in in June. Transplants should be watered at least twice a day if there be no rains at the time of transplanting.

Transplanting beds are 4 feet wide and upto 75 feet long and 9″ high. These beds also are protected by grass shades, 3½ feet high at the lower side and 4½ feet high at the other, to allow room for watering and side light. Topshades are constructed before transplanting is done. These transplanting beds are formed in virgin soil or a top layer of decomposed shola soil or cowdung manure is laid on the beds just before transplanting.

A transplanting bed 4′ × 25′ × 9″ will take 6 coolies (Rs. 2–4–0) to form. A cooly will water 10 beds daily twice if the water be within easy reach A coolie can transplant about 3000 plants a day in prepared beds watering being done by another coolie.

Only healthy vigorous plants are transplanted and small ones left in seed beds. Transplants are allowed to grow for about a year till the June following, by which time they are 3 to 4 feet high, and develop 4 to 8 new root shoots. The whole clumps are taken out of beds and each clump is planted in each pit in the plantation.

Transplants one year old can be purchased at Rs. 50 to Rs. 70 per 1000. It is much cheaper to grow them in a nursery even 4 to 5 miles from one's plantation as the cost of such nursery grown plants fit for planting in the plantation will be only Rs. 25 to Rs. 30 per 1000 transplants.

Plantations. Sholas are the only suitable areas for Cardamom plantations. They are usually situated at an elevation varying from 3500 to 5000 ft. In Travancore the present kist is Rs. 2 per acre. In addition to the kist the pattadar has to pay "Nazar" at Rs. 25 per acre, which may be taken as the tree value. This is paid in instalments within 2 or 3 years from the date of assignment. I am told that in the beginning of this year the "Nazar" was raised to Rs. 85 per acre. Close to Cumbum valley over 10,000 acres of Shola forest are under cardamom cultivation in Vandamet Range of Travancore state. About 5000 acres are said to be still available but assignments to new applicants who are British subjects are not now being made, the land being kept reserved for Travancorians.

In Sholas taken up for cardamom plantation trees are thinned to such a degree as to give a slightly broken canopy to let in light in small patches. The undergrowth is completely cleared. The clearance costs about Rs. 5 per acre.

Then pits, $2' \times 2' \times 1'$ or $2\frac{1}{2}' \times 2\frac{1}{2}' \times 1'$ are dug in straight rows in March—April, the pits being 11′ apart and the lines 8′ to 11′ apart.

A coolie can dig 16 pits of the bigger size and 20 of the smaller in a day. The earth excavated from the pits is put on the lower side of the pits and left there. There are usually 320 to 360 pits per acre and the cost of lining and pitting per acre varies from Rs. 7–8–0 to Rs. 8–8–0.

The pits are refilled in May with the surrounding surface soil, other than the dug out earth. Cost of refilling per acre is Rs. 2–8–0; a coolie can refill daily 50 pits on the average.

There are 2 varieties of cardamoms, the Mysore, and the Malabar or Travancore. The plantations used to be formed of the local Travancore variety till 10 years back, when, due to the general outbreak of disease it was discarded and the Mysore variety newly introduced. All the present plantations are of Mysore cardamoms and this note deals with them alone.

Transplants from the beds are transplanted in the pits soon after the monsoon sets in in June. Cost of transplanting 350 plants in an acre will be Rs. 1–8–0 to Rs. 2.

Soon after the plants have struck root and during the Monsoon season some more branches of shola trees are lopped to let in some more light.

Sometimes in place of nursery plants, old plants from the older plantations (10 to 12 years or so) are dug out carefully with all the rhizomes, and cut into suitable sections so that each section contains one or two new shoots, 3 or 4 such sections are planted in each pit just like nursery grown transplants.

The old shoots die off, their place being taken up by the developing new shoots. Such transplants come into bearing a year earlier than the nursery plants but cease to yield good crops much earlier than the latter. Cost of transplanting old plants is Rs. 10 to Rs. 12 per acre. Such plants too are available for sale but they are generally costlier than nursery plants.

The size of a normal plantation to work on an economic basis should be at least 120 acres, 10 acres of which are renewed annually.

The life of a plantation crop is said to be 10 to 12 years for old transplants and 15 to 20 years for the nursery transplants, if not deseased. Cattle and goats do not eat cardamom plants but elephants cause damage to plantations by uprooting plants to fan themselves or by rolling down in fun and frolic.

Weeding. First weeding is done in September and the 2nd in February to March. They are repeated in the 2nd and 3rd year when the flowering spathes appear. Usually 5 weedings are done before collection of fruit is done in September—October of the 3rd year. Each weeding in the first year will cost about Rs. 5 per acre, in the 2nd year Rs. 4 and in the 3rd year Rs. 3 per acre. Even after the plants come into bearing the weedings have got to be continued and done twice a year (in September and March) till the plants are bearing crops. As the plants usually close up in the 4th year the weeding cost gets less and less and it by then comes to mere scraping and heaping of dead leaves only. This will cost Rs. 3 per acre per annum.

Paths. To enable coolies to do weeding and collection of fruits etc., paths at gentle gradients are made on the slopes. Cost of formation of 3′ to 4′ paths is about 8 annas per chain or Rs. 40 per mile.

Plucking. Fruit spathes appear usually in the 3rd year when the gathering of ripe fruits starts. Plucking is usually done from September to April, there being 5 pluckings at intervals of 30 to 40 days. The ripe yellow capsules and those about to ripe are taken at each plucking. A woman coolie can pluck daily in the first plucking about 4 Madras measures, in the 2nd and 3rd pluckings 10–15 measures, in the 4th 4 to 5 measures, and in the 5th about 2 measures. A man can carry 30 to 35 Madras measures of green cardamoms ; 48 measures go into a gunny. Fresh ripe fruits cannot be stored more than 3 days before drying. Otherwise the capsules split open and the seeds drop out and get discoloured. Crop estimates are generally made as follows :—When from one stem four scapes are threwn out the crop is regarded as full, if only 3, it is three-fourths crop, if two, a half crop; if only one, a quarter crop.

Drying. Fruits are taken to the drying chamber where they are spread in single layers in trays or on bamboo mats or gunny spreads on floor and on shelves. The drying chamber is the upper storey which is kept at a constant temperature by the circulation of hot air rising from the lower storey wherein hot air is kept moving in two zinc pipes from the oven wherein firewood is continuously burnt day and night. The oven is either inside or outside the lower storey. The drying period for a charge is 20 to 24 hours evening to evening. Capsules should get thoroughly dried and attain either green or white colour and when shaken should give a rattling sound. While hot the capsules are rubbed by hand on trays, 3′ × 4′ the bottom being of wire mesh, 10 to 12 mesh to 1 inch. This rubbing is done to remove the flower stalks etc. and to give a light polish to capsules. About 5 measures can be dealt with at a time on a tray by 2 men. Cost of drying works out to Rs. 1 to Rs. 1-8-0 per bag of 48 measures, and of polishing about 8 annas per bag of green or 1 Thulam of dry. It is generally held that the ratio of green to dry cardamom is 3½ : 1; in selected good fruits it is 3 : 1. In a miscellaneous collection a bag of green cardamoms (48 measures) is said to yield a thulam (20 lbs.) of dry. Drying in sun on sheet rocks is not now resorted to as the colour becomes dirty white which is not liked. The green shade of kiln-dried stuff is mostly in demand.

The dried and cleaned cardamoms are packed in gunnies and sent by coolies or mules to Cumbum where they are further cleaned and sorted out for sale. A cooly can carry 65 lbs. of dry or 30 measures of green. 10 to 12 Madras measures of dry cardamoms weigh 1 thulam (20 lbs.). So a Madras measure can be taken as about 2 lbs.

Yield. With the appearance of the flowering spathes usually in the 3rd year the plants commence to yield crops. A light yield of 1 to 3 thulams of dry capsules per acre can be obtained in the 3rd year. In rare cases even 5 thulams can be had this year. In the 4th year the yield will be 5 thulams and from 5th year onwards 5 to 10 thulams per acre till the 15th year after which the yield is said to fall off.

The maximum annual yield from the best plant is 20 lbs: the average annual yield from a plant is 2½ measures, about 2 lbs. (dry).

The normal outturn per acre in the estates visited varies from 150 to 250 lbs. of dry cardamoms.

Cost of formation of a new plantation one acre in extent.

1st year.		Rs.	as.	ps.
Royalty to Government	...	25	0	0
Annual kist	...	2	0	0
Cost of clearing	...	5	0	0
,, of lining and pitting	...	8	0	0
,, of filling in pits	...	2	8	0
,, of transplanting the plants	...	1	8	0
,, of transplants, 350	...	20	0	0
,, of 2 weedings	...	10	0	0
,, of overheads etc.	...	10	0	0
		= 84/-		

2nd year.				
Annual kist.	...	2	0	0
Cost of 2 weedings	...	8	0	0
,, of replacing casualities	...	5	0	0
,, of overheads	...	5	0	0
		= 20/-		

3rd year.				
Annual kist	...	2	0	0
Cost of 2 weedings	...	6	0	0
Replacing casualities and overheads	...	10	0	0
		= 18/-		

Rs. 122/-

Income: 3 thulams at Rs. 22 Rs. 66/-

Sale value of such a plantation varies from Rs. 150 to 300 per acre according to the current price of dry cardamoms and the soil and situation of the area.

4th to 15th year.	Rs.	as.	ps.	
Plantation in bearing (at 7 thulams per acre) kist	2	0	0	
Cost of 2 weedings etc....	5	0	0	
,, of replacing casualities ...	5	0	0	
,, of plucking 7 kalams.	10	8	0	at Rs. 1-8-0 per bag.
,, of drying ,, ...	8	12	0	at Re. 1-4-0 per bag.
,, of polishing etc. ...	2	10	0	at 6 annas per bag.
,, of transport to Cumbum a kalam ...	1	8	0	at 12 annas per bag.
,, of cleaning & sorting	1	0	0	at 8 annas per bag.
Overheads etc. ...	13	0	0	
	50	0	0	

Income: 7 thulams at Rs. 22 = Rs. 154/-

Price. The present wholesale rate for cardamoms in Cumbum valley is Rs. 22 to Rs. 25 per thulam ($20\frac{3}{4}$ ℔s). Picked capsules realise Rs. 5 more per thulam.

The current rates are very low due to slump in trade. 5 years back the prices ranged from Rs. 35 to Rs. 60 per thulam.

8. Have you sufficient knowledge concerning the soil in your Forests?

By Ralph C. Hawley and Ghester A. Coover.

Agricultural experts have already developed methods for ascertaining the condition of the soil on farm lands and have become proficient in improving soil fertility and hence crop production by the application of fertilizers to supply deficient elements. Similarly in forest crop production, methods for ascertaining the condition of the soil ought to be developed and knowledge acquired as to particable means of improving forest soil fertility. Certainly the application of fertilizers as used in agriculture is impracticable. Forest soil improvemnt may come principally through maintaining crops of the correct composition and through protection and silvicultural treatment of the stand. Consequently a thorough knowledge of silviculture is fundamental to the development of efficient forest soil management.

Romell and Heiberg have emphasized the importance of the humus layer in controlling surface soil condition and, as their principal original contribution, have proposed a classification of the humus layer which should prove of value both to the research worker and to the practicing silviculturist. By " humus layer " is meant the top layer of the soil characterized by its content of organic matter which may be high or low and may occur either as a layer upon the mineral soil or incorporated with the soil. It does not include the fresh organic debris (litter) which as yet shows little evidence of decomposition.

The immediate purpose in studying the humus layer in the Eli Whitney Forest was to determine the situation in regard to types of humus layer represented in the forest, and to test the workability under Connecticut conditions of the humus layer classification suggested by Romell and Heiberg. Ultimately it is hoped that practicable treatment for improving soil conditions in the individual stands can be developed.

A representative sample was obtained by studying the humus layer on 163 areas distributed throughout the various cover types and age classes proportionately to the area occupied by such units. Three soil pits were opened on each area, field measurements and observations recorded and samples taken into the laboratory for analysis of organic content and acidity.

In general the classification of humus layer types proposed by Romell and Heiberg proved applicable to southern Connecticut conditions. Long periods of abusive treatment such as frequent burning over, heavy grazing and clear cutting at too frequent intervals have on portions of the forest area inhibited the development and maintenance of the characteristic humus layers to be expected on properly managed lands of the same ferest types. Thus many immature forms of humus layer were found but on the whole there was little difficulty experienced in placing samples under the Romell-Heiberg classification, This classification recognizes two groups of humus layer types, namely, the mull group in which the humus material is incorporated with the mineral soil and the duff group in which a pronounced layer of unincorporated humus covers the ground.

Hemlock-hardwood stands showed both mull and duff conditions but inclined toward a leaf duff which may be characteristic of this type. The hardwood swamps and southern white cedar swamps have humus layers of greasy duff. This type of layer was found only in the swamps.

The chief point of interest to the forest manager is whether and to what extent the different types of humus layer can be correlated with the productive capacity of the site. The present preliminary study cannot answer this question other than to indicate possible trends. The investigation indicates a gradual but consistant decrease in fertility in going from crumb mull at the upper extreme to greasy duff at the lowar limit. Plant growth and site conditions on areas with humus layer types other than crumb or grain mull sometimes appear to equal those of areas with crumb mull. But examination shows that areas with good crumb mull usually support a greater variety of species and and more productive stands. Crumb and grain mull are more characteristic of the better site qualities while the duff forms of humus layer predominate on the poorer sites. Twin mull occurs most frequently on the medium quality sites.

Crumb mull as sampled here is characterized by a greater abundance and larger number of species of soil fauna than any other type of humus layer. Large earth-worms are especially characteristic. This in itself may indicate a forest soil in the best of tilth. The best examples of crumb mulls were found under hardwood stands over 20 years of age on well-drained swales and lower slopes.

Such is the present situation. It remains to be seen whether with the cessation of forest fires, grazing and other forms of mismanagement and with or without the application of intensive silvicultural treatment the better types of humus layer can be developed throughout the forest. That improvement on many areas can be attained seems certain. Possibly it may be found that moisture relations and forest composition are peramount factors (under given climatic conditions) which determine the type of humus layer to be found on each site quality.

It may be that each forest cover type develops a humus layer type differing from that characteristic of certain other forest cover types. This would lead to the inference that best growth and perhaps the most promising reproduction may occur in one forest cover type when the humus layer is, for example, a leal duff while in some other cover type best growth is secured only with a crumb mull humus layer. The best humus layer conditions which can be attained in each of the various forest cover types are, at least, in southern Connecticut, as yet undetermined for all these types although evident for some cover types. Appraisals such as the one described followed over a period of years by observation of changes in humus layer conditions which may take place on specified areas should result in obtaining for the forest manager much of the information he needs concerning the conditions of his forest soil.

— *Journal of Forestry, April 1934.*

9. Development of Wood Consumption in Various Countries :

Investigations of past trends in wood consumption are valuable for the light they may throw on possible future tendencies. They are particularly timely in a period, such as the present, when a spirit of pessimism prevails in the forest industries, and when so much is heard about a permanent decline in the use of wood. Such a study has been made by Dr. Von Monroy.

In Germany wood consumption per capita has been fairly constant since 1870. From 1900 to 1913 there was a small increase. This was followed by an insignificant decline from 1913 to 1928. Since 1928, of course, wood consumption has substantially declined on account of the financial depression. But even during the depression the consumption of wood has remained more stable than the consumption of pig-iron and much more stable than that of coal and lignite.

After presenting the more important statistics on world wood consumption from the Copeland Report, Von Monroy comes to the conclusion that, in spite of the substitution of other raw materials in places, wood consumption per capita has not generally decreased. He finds most interesting the trends in Russia and in the United States. Since the inauguration of the five-year plan in Russia wood consumption has increased tremendously due to the use of wood in the industrialization process. In the United states the wood consumption per capita has gradually declined since the peak in 1906. This has been due, according to Von Monroy, to the development of the country. The existence of large areas of virgin forest fostered wasteful utilization in the early days and resulted in a large per capita consumption. With destructive cutting of the most accessible forests and the development of the coal and iron industries, which furnished substitutes for wood, the per capita consumption has declined.

In the cities of the United States, where the heaviest competition of other raw materials might be expected, wood has not only held its own but has increased in use. From 1912 to 1918 the consumption of wood for urban residential construction has increased by 33 per cent, while for other urban construction purposes the consumption has increased by 2 per eent.

The sustained consumption of wood, which is observed in nearly all countries, may be laid principally to the multiplicity of its use—a versatility which is greater than in the case of any other raw material. But these use possibilities should be extended. Wood possesses more favourable mechanical properties for many purposes than does iron. From the physical standpoint, wood used in proper form is more resistant to fire and oxidation and is more sound-proof and a poorer conductor of heat than any other construction material. Other advantages are its easy workability and its beauty. Low ash content, cleanliness, and absence of sulphur are valuable properties of wood as fuel, both for heating and power purposes. Its utilizatien as a power fuel in gas form or in liquid form (alcohol) is necessary for all countries which, like Germany. do not possess extensive oil resources of their own. The increase in the world cousumption of pulpwood by 2½ times from 1911 to 1929 shows the trend in the use of wood in this direction.

Dr. Von Monroy's conclusion is that, in spite of the difficult market conditions of the present time, wood will retain its place among other raw materials on account of its many desirable technical properties. But in order to maintain this position it is essential that the further extension of the old uses for wood and the opening up of new uses be promoted more systematically and more vigorously than in the past.

— *Journal of Forestry, April 1934.*

10. Treated Poles in America:

Increasing in Use.

A study of the pole consumption of three of the largest American telegraph corporations indicates a gradual trend toward the use of pressure creosoted pine poles. In 1925, 44.3 per cent. of the poles used by the American Telephone and Telegraph Co. were pressure creosoted pine. During each of the last five years creosoted pine poles installed by this company have greatly outnumbered poles of any other single species.

In 1929, only 10 per cent. of the poles used by the Western Union Telegraph Co. were pressure creosoted pine. During each of the next four years this percentage increased gradually to approximately 20, 30, 40, and 50 per cent. respectively, of the total poles used. In 1933 the pressure creosoted pine poles greatly outnumbered those of any other species.

During the last five years the Postal Telegraph-Cable Co. used a higher percentage of creosoted poles than either of the other two companies.

Since 1929, very few untreated poles have been used, states *Wood Preserving News*, the organ of the American Wood Preservers' Association, and during the five year period, 1929 to 1933, inclusive, creosoted pine poles averaged 53.2 per cent. of the total poles used by the three companies. For the two year period, 1932 and 1933, this figure was 62.3 per cent. Untreated poles used decreased from about five per cent. in 1929 to four-tenths of one per cent. in 1933.

11. Observations on the Natural Dissemination of Spike:

[*Extracted from*: " *Memoirs of the Indian Institute of Science, Vol. I, No. 26.*
Field Studies in the Spike Disease of Sandal,"
—By, M. Sreenivasaya, B.A., F.I.I.Sc., and S. Rangasami.—Sep. 1934.

The discontinuity in the natural spread of the disease and the consequent occurrence of isolated outbreaks of spike in areas far removed from all apparent sources of infection is explained on the basis of the possible dispersal of (1) the virus bearing seeds and (2) the viruliferous vectors, whose long distance transport in facilitated by wind and other agencies.

The possibility of Spike virus being transmitted through seed has been experimentally indicated and explained in the light of the recent work of Bewly and Corbett and others.

The frequent association of agricultural fields or abandoned sites of cultivation with the primary outbreaks of spike, has been established in almost every case that is examined. The denuding effect of agricultural colonies and their operations on the forests close by and the exposed positions which sandal plants occupy in consequence are suggested to predispose the sandal plants to disease.

The parallel spread of mosaics and leaf-curls among the associated flora (weeds) with the spread of spike is highly suggestive and indicates that the environment is favourable for the multiplication and spread of viruliferous vectors.

Lantana has an important role in the spread of the spike disease.

Attention is drawn to the occurrence of insect scars during the months of April, May and June, and its usefulness as a measure of insect activity in a given area indicated.

The season during which the vector is most active and virulent, has been determinod by the platform experiments extending over two years The results show that the period April–June is the principal season during which the natural infection vigorously proceeds in forests, while a second season of infection during October–December is also indicated by the results.

Experiments on the caging of sandal plants growing under silvicultural conditions in a highly infected area show that caging will effectively screen off the vectors. The fact that none of the cage plants has succumbed to the disease during a period of now over two years shows that root transmission plays a very minor role in the spread of spike under natural conditions.

Experiments on the grafting of big sandal trees have shown that even small doses of infective tissue (80 to 100 milligrams) if introduced at the vulnerable point during the susceptible season are adequate to spike even big trees of Sandal. The quantity of the material is so small that its carriage by a swarm of insects is not improbable.

April–June appears to be the most critical period in the life of the Sandal plant. During this period insect fauna becomes visibly active in sandal forests and there is a heavy infliction of scars on the tender shoots of sandal. The sandal plant is most susceptible to infection during this period and if a practical means could be found to protect them during these months there is every chance of the plants remaining "safe" for the rest of the year

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12. Tests on Poles:

Methods of Preservative Treatment in Australia.

In November, 1932, a number of experimental poles were installed at Belgrave and Benalla, Victoria, in connection with a series of tests carried out by the Australian Division of Forest Products. Recently additional poles, which have been seasoned for about twelve months, have been added to the others in the test plots. In this experiment only one species of timber, namely, *E. obliqua* (messmate), has been used.

Eight different methods of preservative treatment are being investigated by the Division, using in some cases both green and air-dried poles. Untreated poles have also been included for comparative purposes. The various preservative treatments employed are: (i) creosote under pressure—full length of pole, (ii) creosote open tank treatment of butt only, (iii) creosote brush treatment together with puddling of the surrounding soil with creosote, (iv) crude oil and arsenic solution brush treatment with puddling of the soil, (v) the use of collars of white arsenic, (vi) collars of a mixture of sodium fluoride and white arsenic, (vii) charring by means of an oxy-acetylene flame followed by spraying with creosote and soil puddling, (viii) the use of a bandage method of pole preservation developed in Germany. The poles used in these experiments were either 10 or 20 ft. long, the length depending on the method of treatment.

In February last a preliminary inspection of the poles was carried out and it was found that at Belgrave large numbers of the untreated poles were already attacked by decay, the sapwood in some of the unsapped poles being completely destroyed. At Benalla, termites had also caused damage to the untreated poles. At both places some of the collar treated poles were slightly attacked by decay or termites. The remaining treated poles were in excellent condition. Further inspections will be made annually and a report will be published as soon as sufficient reliable data are obtained.

— *Timber Trades Journal, 21–7–34.*

13. Collapsed Timber :

Method of Treatment.

The reconditioning of collapsed timber on a commercial scale is widely adopted throughout Victoria and Tasmania, but in order to assist anyone desirous of utilising the treatment the Australian Division of Forest Products have prepared a circular which gives in simple form all the necessary information on the subject.

The practical value of the reconditioning treatment has been proved beyond doubt, states the circular, by many years of commercial application. Although several points require further investigation, the present method of treatment can be adopted with every surety of satisfaction. Included in the publication are a few recommendations which have not been published previously and which are made following investigations carried out by the Division during the past two or three years.

Regarding treatment, the collapsed timber is strip-stacked and placed in a simple steam-tight chamber, the door closed, and steam admitted to the chamber for just sufficient time to cause the boards to swell back to a regular shape, with all traces of collapse removed. In cases where there is no obvious collapse, the time after which no further gain in size occurs must be determined by experiment, and the treatment given for this time.

During the treatment, a certain amount of moisture is absorbed by the cell walls, which swell and resume their normal shape. This absorbed moisture must then be dried out, the charge being removed from the steaming chamber and placed in a kiln for a few hours, or air-dried for a few days. As the amount of moisture absorbed is not great and is confined mainly to the surface layers of each piece in the charge, the re-drying after steaming is not a lengthy procedure. It is none the less essential.

On re-drying, provided the steaming has not been continued too long, the stock will retain the normal regular shape restored by the steaming treatment, and will, moreover, have greater dimensions than it had before being steamed. The idea that the treatment will yield dry stock of the same dimensions as when green is, however, erroneous. Normal shrinkage is not eliminated by the treatment. If the steaming is continued too long, free water will collect in the cell cavities and the stock will collapse again when re-dried. It is therefore essential to ascertain the correct duration of treatment.

The moisture content of the timber prior to treatment must be below fibre saturation point and preferably should be below 20 per cent.

An inky-black liquid sometimes drains from a reconditioning chamber during the steaming of some timbers. The cause of this is the removal of small quantitles of tannins from the outer surfaces of the stock, these tannins reacting with iron-work in the chamber to form a black substance which colours the condensed steam draining from the chamber. No harm is done to the timber by the removal of these tannins, and the quantity leached out is minute, despite the pronounced colour.

— *Timber Trades Journal, 4–8–34.*

14. Use of Beechwood for the manufacture of bentwood suit-cases :

As raw material, only sound timber, tenacious, of good quality and entirely stripped of branches must be used ; timber with red heart must be rejected in any case, as even if not interfering with the curvature operations, it greatly diminishes the value of the manufactured goods by the variations of colour resulting ; timbers from calcareous and clayey soils are superior to those coming from sandy soils.

For the curvature, the material most suitable is beechwood sawn shortly after felling. It is only the timber still rich in sap that makes the working easy and successful. If the timber is dried before sawing, certain substances (cellulose, sugars, dextrin, starch, oils, albumin, tannic acid, lignin etc.) undergo changes which render the timber less elastic oven when exposed to the steam treatment.

The pieces of wood intended for the curved portions of the suit-cases are sawn to a prescribed length following the longitudinal fibres and are then submitted to a steam pressure of 9.5 to 2 atmospheres. After a lapse of time varying from 10 to 120 minutes according to the species of tree and the size of the piece, the curving may be effected without risk of fracture. A certain temperature it required for the operation. The resistence to pressure of wood thus curved increases after drying by 7% on an average along the length, and by 20 to 30% in the direction at right angles to the fibres.

— *International Review of Agriculture, Rome, September 1934.*

15. Gulls destroy grasshoppers :

It is surprisingly seldom that one comes across telling examples of the activity of birds as destroyers of harmful insects. F. Bradshaw records an interesting experience in Canada, where on June 18, 1933 he observed what in the distance appeared to be a cloud of smoke, but on nearer approach turned out to be enormous flocks of the black headed Franklin's gull, They alighted in column formation and gorged upon an army of grasshoppers. The number of birds present could not be estimated closely, but the column of close-set birds was a mile in extent and sixty birds in width, and two miles to the south west, an even larger crowd of gulls was seen. Estimates suggest that a Franklin's gull might devour 500 grasshoppers daily ; the protective value of a flock which at a very conservative estimate numbered more than a million, is, therefore of considerable moment.

— *Nature, Oct. 13, 1934.*

COLLEGE NOTES.

1. Forest Engineering :

As from the current year, the College Camp at Aiyur in North Salem, will be followed by a ten days' camp at the Head Quarters of the Queen Victoria's Own Sappers and Miners, at Bangalore, for a practical training in field works. The latter will include : field-geometry ; reconnaisance of work, trenches and earthwork ; revetment, sand bags, hurdles, gabions etc. ; anchorages, knots and lashings ; spars and derricks, trestle bridge, crib piers ; demolitions, rafts, floating piers etc.

2. Visit of the Inspector General of Forests :

C. G. Trevor Esqr., C. I. E., I. F. S., Inspector General of Forests, India, accompanied by A. Wimbush **Esqr**, I F. S., Chief Conservator of Forests, Madras, made an informal inspection of the College and the Museum on the 5th October last. We shall be glad to avail ourselves of the offer of the Inspector-General, of help in augmenting certain sections of the museum.

3. The Madras Forest College Athletic Sports, 1934 :

The College Sports were held on Saturday, the 27th October 1934. It had rained heavily the previous two days and the ground was marshy in many places on the course. The weather on the sports day itself was very fickle, with the result that the spectators were few, and the events of the programme were too frequently and inconveniently punctuated by sudden showers. No records were broken, perhaps due to very slippery ground, but it is gratifying to note that no legs were broken ! A record number of points (marks) was however, obtained by Senior Student Ahmed Sheriff, who won the Richmond Cup, with twenty nine points. We offer him our congratulations.

The prizes were kindly distributed by Mrs. C. C. Wilson. The following are details of the events :—

I. *High jump :*
  I. Ahmed Sheriff ... 5 ft. 1 in.
  II. K. Virapam.
  III. N. Rebeiro.

II. *100 yards :*
I. Ahmed Sheriff ... 11⅖ Sec.
II. N. Rebeiro.
III. J. B. Lobo.

III. *Invitation Half-mile :*
I. Stanes' European High School ... 2 Min. 15⅛ Sec.
II. Union High School ...
III. Agricultural College.

IV. *Quarter-mile* :
I. Ahmed Sheriff ... 1 Min ⅕ Sec.
II. J. B. Lobo.
III. C. P. Bhimayya.

V. *Javelin throw* :
I. Mir Mohommed Ali ... 109 ft.
II. J. B. Lobo.
III. N. Rebeiro.

VI. *Hurdles :*
I. K. Virapam ... 20½ Sec.
II. N. Rebeiro.
III. Ahmed Sheriff.

VII. *Shot-put :*
I. Mir. Mohommed Ali ... 2 Min. 30½ Sec.
II. N. Rebeiro.
III. T. R. Vijayaraghavan.

VIII. *Half-mile :*
I. Ahmed Sheriff ... 2 Min. 30½ Sec.
II. C. P. Bhimayya.
III. P. S. Sivaramakrishnan.

IX. *Long jump* :
I. Ahmed Sheriff ...
II. N. Rebeiro.
III. C, P. Bhimayya.

X. *Peons' race* :
I. Allavi.
II. Krishnasamy.
III. Ramasamy.

XI. *Mile-Race* :
I. S. Sirajjuddin ... 6 Min. 41 Sec.
II. Ahmed Sheriff.
III. M. R. Thiruvenkatachari.

XII. *Relay Race* :
I. States Team ... $54\frac{2}{5}$ Sec.
II. Kerala.
III. Madras.

XIII. *Cycle-race* :
Not run, due to slippery ground.

XVI. *Tug-of-war* :
Won by, Recruit School.

4. Tennis :

A friendly match in Tennis doubles was played between the Government Victoria College, Palghat and the Forest College in the Forest College Courts on Sunday, the 4th November 1934. Both sides were equally balanced and there was a keen fight. The game extended to three sets in all. The first set was captured by the Forest College after a gruelling struggle extending to 14 games. In the second set each side won their service games till 5 all was called when Palghat playing magnificant tennis annexed the next two games to win the set. In the third and final set, the Forest College rallied round and won comfortably conceding only three games to their opponents. Mr. Natarajan played a good game for the Palghat College.

The final scores were : Ferest College beat Government Victoria College, Palghat :— 8–6; 5–7; 6–3.

Senior Students V. Govinda Menon and N. V. A. Ribeiro represented the Forest Gollege.

V. G. M.

5. Hockey :

In October last the M. F. C. Hockey team played two matches with Papanaikanpalayam Stdents' Club on 12th and 20th. The first match was played on our ground and second on the latter's. In both the above matches our team was successful the scores being 2 : 1 and 2 : 0 respectively.

During the Senior Division's Camp at Calicut and Nilambur two matches were played, one at Calicut with Malabar Christian College on 9–11–34, and the other at Nilambur with Malabar Special Police "O" Company on 24–11–34.

In both the above matches we were defeated by a narrow margin of one goal in each case.

S. SIRAJJUDDIN.

6. The Annual Swimming Race (Nedungayam) :

The Annual Swimming race of the College which involves only the Senior Division students, was conducted, by the Second Senior Instructor on the 13th December 1934 at 5 P. M. at Nedungayam. Mr. C. C. Wilson, the Working Plans Circle Conservator, and Mrs. Wilson kindly acted as judge and timekeeper respectively.

The course was the usual one just on the down-stream side of the Nedungayam bridge and was 400 ft. long. Since the pool here is deep, broad and still, none of the competitors can be said to have had any advantage gained from the current with which they swam.

The evening was bright and sunny and it was with cheerful faces that all the competitors stepped on to the starting point. There were in all thirteen of them to start with but one of these as though flurried or worried by the inauspicious "thirteen" swam up to the bamboo raft which was being rowed along side of the course by the Havildar, immediately after the race was started by the Instructor. The remaining twelve dashed down, presenting a spectacular scene. When at last the winning point was reached amidst the encouraging uproar of the on-lookers and judges, V. Madhava Menon was leading and P. Narayan Nair was quite close behind him making a futile struggle to beat him out, after having gained over A. Yagnaswamy who was till then following Madhava Menon. Madhava Menon took 2 minutes 20 seconds to finish the course.

It may be quite in place to point out here that last year too Madhava Menon came first in the swimming competition held for the Junior Division at Kargudy. We heartily congratulate him on his success in both the tests.

C. P. BHIMAYA.

NOTICE.

Indian Forester Prize — 1934.

Essay Prize for past students.

The subject for essay is :—

" The Education and Training of a Range Officer, being comments from personal experience and with suggestions for the future."

A prize valued at about Rs. 25 will be awarded for the best essay from past students.

No award will be made unless a satisfactory standard is reached. The essay should be clearly written or typed on one side of the paper only and should not exceed 2000 words. It should be submitted to reach the Principal between the 10th May and 1st June 1935. An essay not received within this period will not be considered. This should be the unaided work of the competitor.

(Sd.) P. W. DAVIS,
Principal,
Madras Forest College.

Notifications Relating to Rangers.

The following promotions of Rangers are ordered :—

I.

With effect from the 29th May 1933 - vice Ranger P. Muthuswami Ayyar reduced to the 2nd Grade :—

Mr. T. K. Ramaswami Ayyar from 2nd Grade permanent to First Grade permanent.

II.

With effect from the 6th June 1933 in the vacancy in the Fourth Grade caused by the revision of the Rangers' cadre :

1. Mr. U. Vriddachalam Pillai, from Fourth Grade sub protem to Fourth grade permanent. 2. Mr. A. B. Fenn from Fifth Grade permanent to Fourth Grade sub protem. 3. Mr. K. Purushothama Rao from Fifth Grade sub protem to Firth Grade permanent. 4. Mr. N. S. Eswara Ayyar from Sixth Grade permanent to Fifth Grade sub protem. 5. Mr. K. O. Anandam from Sixth Grade sub protem to Sixth Grade permanent. 6. Mr. T. Sriramalu Nayudu from Seventh Grade permanent to Sixth Grade sub protem. 7. Mr. V. Viraswami Nayudu from Seventh Grade sub protem to Seventh Grade permanent. 8. Mr. C. K. Unni from Seventh Grade temporary to Seventh Grade sub protem. 9. Mr. V. N. Parthasarathi Nayudu, Trained Forester, to Seventh Grade Ranger, temporary.

III.

With effect from the 6th June 1933 in the vacancy in the Third Grade consequenut on the revision of the cadre of the Rangers :

1. Mr. G. Rama Rao, from Fourth Grade sub protem to Third Grade permanent, 2. Mr. A. B. Fenn, from Fourth Grade sub protem to Fourth Grade permanent. 3. Mr. I. Z. Robert Paul from Fifth Grade permanent to Fourth Grade sub protem. 4. Mr. N. S. Eswara Ayyar, from Fifth Grade sub protem to Fifth Grade permanent. 5. Mr. D. N. Subramania Ayyar from Sixth Grade permanent to Fifth Grade sub protem. 6. Mr. Sriramulu Nayudu from Sixth Grade sub protem to Sixth Grade permanent. 7. Mr. P. Gopalan from Seventh Grade permanent to Sixth Grade sub protem. 8. Mr. C. K. Unni from Seventh Grade sub protem to Seventh Grade permanent, 9. Mr. A. Muhammad Akbar from Seventh Grade temporary to Seventh Grade sub protem. 10. Mr. S. Varadarajulu Reddy from Forester First Grade, to Ranger Seventh Grade temporary.

IV.

With effect from the 28th June 1933 - vice Ranger C. Karunakara Menon - Invalided :

1. Mr. I. Z. Robert Paul from Fourth Grade sub protem to Fourth Grade permanent. 2. Mr. P. B. Saiyid Yahia from Fifth

Grade permanent to Fourth Grade sub protem. 3) Mr. D. N. Subramania Ayyar from Fifth Grade sub protem to Fifth Grade permanent. 4. Mr. C. R. Rajagopalan from Sixth grade permanent to Fifth grade sub protem. 5. Mr. P. Gopalan, from Sixth grade sub protem to Sixth grade permanent. 6. Mr. A. Subramaniam from Seventh grade permanent to Sixth grade sub protem. 7. Mr. A. Muhammad Akbar from Seventh grade sub protem to Seventh grade permanent. 8. Mr. M. P. Halasyanatha Ayyar, from Seventh grade temporary to seventh grade sub protem. 9. Mr. Abdul Razack, Forester, First grade to Ranger Seventh grade temporary.

V.

With effect from the 9th October 1933, vice Ranger K. R. Krishna Ayyar, Fourth Grade invalided :

1, Mr. P. B. Saiyid Yahia from Fourth grade sub protem to Fourth grade permanent. 2. Mr. B. T. Sitarama Ayyar from Fifth grade permanent to Fourth grade sub protem. 3. Mr. C. R. Rajagopalan from Fifth grade sub-protem to Fifth grade permanent. 4. Mr. G. V. Subba Rao from Sixth grade permanent to Fifth grade sub protem. 5. Mr. A. Subramaniam from Sixth grade to sub protem to Sixth grade permanent. 6. Mr. S. Venkatarama Ayyar from Seventh grade permanent to Sixth grade sub protem. 7. Mr. M. P. Halasyanatha Ayyar from Seventh grade sub protem to Seventh grade permanent, 8. Mr. V. N. Parthasarathy Nayudu from Seventh grade temporary to Seventh grade sub protem. 9. Mr. K, Subbaraya Ayyar, Forester First grade to Ranger Seventh grade temporary.

VI.

With effect from the 9th October 1933 in the two additional temporary posts sanctioned in G. O. No. 675, Development, dated the 6th June 1933 :

1. Mr. P. Shanmugasundaram Pillai, Forester First grade to Ranger Seventh grade temporary. 2. Mr. V. V. Anjaneyulu, Forester First grade to Ranger Seventh grade tomporary.

VII.

With effect from the 14th October 1933, vice Ranger K.M. Gopalacharya reduced to the Fourth grade :

Mr. K. S. Ramayya from Fourth grade permanent to Third grade permanent.

VIII.

With effect from the 1st November 1933 vice Ranger M. Krishna Rao, Third grade invalided :

1. Mr. K. Tiruvenkatacharya from Fourth grade permanent to Third grade permanent. 2. Mr. B. T. Sitharama Ayyar from Fourth grade sub protem to Fourth grade permanent. 3. Mr. A. Bhavayya from Fifth grade permanent to Fourth grade sub protem. 4. Mr. G. V. Subba Rao from Fifth grade sub protem to Fifth grade permanent. 5. Mr. V. N. Subrahmania Ayyar from Sixth grade permanent

to Fifth grade sub protem. 6. Mr. S. Venkatarama Ayyar from Sixth grade sub protem to Sixth grade permanent. 7. Mr. V. N. Leapingwell from Seventh grade permanent to Sixth grade sub protem.

IX.

With effect from the 22nd January 1934 vice Ranger L. J. Taylor, Second grade, died:

1. Mr. J. S. Rowland from Third grade permanent to Second grade permanent. 2. Mr. P. A Krishnaswami Mudaliyar trom Fourth grade permanent to Third grade permanent. 3. Mr. A. Bhavayya from Fourth grade sub protem to Fourth grade permanent. 4. Mr. Y. Peddalakshmayya Nayudu from Fifth grade permanent to Fourth grade sub protem. 5. Mr. V. N. Subrahmania Ayyar from Fifth grade sub protem to Fifth grade permanent. 6. Mr. N. Chakrapani Ayyangar from Sixth grade permanent to Fifth grade sub protem. 7. Mr. V. N. Leapingwell from Sixth grade sub protem to sixth grade permanent. 8. Mr. Y. Vaidyanathan from Seventh grade permanent to Sixth grade sub protem.

X.

With effect from the 17th March 1934, vice Ranger K. Tatacharya, Third grade, retired :

1. Mr. G Devanayagam Nayudu from Fourth grade permanent to Third grade permanent. 2. Mr. Y. Peddalakshmayya Nayudu from Fourth grade sub protem to Fourth grade permanent. 3. K G. Monappa from Fifth grade permanent to Fourth grade sub protem, 4. Mr. N. Chakrapani Ayyangar from Fifth grade sub protem to Fifth grade permanent. 5. Mr. K. Kunhiraman Menon, from Sixth grade permanent to Fifth grade sub protem.

Waltair Circle.

4—10—34. On relief by Ranger Ch. Ramamurti of the charge of Balliguda Range, Mr. A. S. Kaunds (M. R. H.) Forester Second grade, is transferred to Guntur Division.

14—10—34. Mr. C. S. King, Ranger, Second grade on expiry of leave to Polavaram Range, Godavari Lower Division. 2 On relief by Mr. C. S King, Mr. A. Tirupatirayudu, Ranger Sixth grade to charge of Marriguden Range, Godavari Upper division.

22—10—34. Mr. N. Chakrapani Ayyangar, Ranger Fifth grade on return from leave is attached to Gudem Agency Range, Vizagapatam Division.

27—10 –34. Mr. M. B. Madappa, Forester Second grade, to Bezwada Range in relief of Ranger Y. Vydyanathan reported sick with blackwater fever.

2—11—34. Mr. A, S. Kaunds, Forester Second grade (M. R. H.) promoted to act as Ranger, Seventh grade, vice Mr. Ch. Ramamurti, Ranger Seventh grade granted leave from 8–10–1934.

8—11—34. Mr. Y. Vydyanathan, Ranger Seventh grade, Guntur District, granted leave for two months from 8—10—1934.

9—11—34, Mr. V. Rangachari, Forester First Grade (M. R. H.) will continue to act as Ranger, Seventh grade from 1—11—34 to 13-12-34 vice Ranger P. S. Varadakrishnamachari granted leave preparatory to retirement.

15—11—34. The leave for 4 months granted to Mr. N. Chakrapani Iyengar, extended for 4 months.

14—11—34. Mr. P. Dhananjaya Rao, on relief by Ranger A. Thirupatirayadu, to Bezwada Range, Guntur District 2. Forester M. B. Madappa, M. R. H., on relief by No. 1 attached to Guntur District for special duty. 3. Mr. Y. Vaidyanathan, Ranger Sixth grade, Rajamundry Range, Godavari Lower Division. 4. Mr. J. D. Theodore, on relief by No. 3 to Vinukonda Range Guntur District. 5. Mr. D. Krishnaswamiah, on relief by No. 4 to Palnad Range, Guntur District, relieving Forester K. V. Lakshmikanta Rao.

16—11—34. The leave on average pay for one month from 8-10-34 granted to Mr. Ch. Ramamurthi, Ranger Seventh grade, is extended by leave on average pay for 2½ months. 2. Mr. A. S. Kaunds (M. R. H.) Forester Second grade will continue to hold charge of Balliguda Range.

18—11—34. Consequent on the grant of leave for 4 months to Mr. N. Chakrapani Iyengar, the posting ordered in this office S. O. No. 63/34 dated 22-10-34 is cancelled.

21—11—34. Mr. A. S. Kaunds, Forester Second grade (M. R. H.) will continue to act as Ranger Sixth grade (New scale) from 8-11-34 to 22-1-35 *vice* Mr. Ch. Ramamurthi, Ranger Seventh grade on leave.

29—11—34. This office service order granting leave for 20 months and 24 days from 26-11-1934 to Ranger Kirimani Sahib is cancelled.

Bellary Circle.

23—10—34. Mr. B. T. Seetharama Iyer, Ranger Fifth grade Kurnool west division granted extension of leave for three months from 12-10-1934 in continuation of the leave already granted.

25—10—34. Mr. S. Varadarajulu Reddy, now working in Cudapah North Division posted to Turimella Range, Knrnool East division; 2. Mr. S. M. Krishnaswami Iyer, Turimella Range, Kurnool East Division, on relief by No. 1 transferred to Kadiri Range, Anantapur Division. 3. Mr. T. M. Krishnamachari, Kadiri Range, Anantapur Division on relief by No. 2 to special duty in Kurnool South division.

Salem Circle.

25—9—34. Mr. M. B. Kalappa, Trained Forester First grade and Ag. Ranger Seventh grade, on special duty in Salem South division, granted leave for four months from date of relief, 3—10—34. Mr. P. K. Subbanarayana Ayyar, Anchetti Range, Salem North Division posted to special duty in the same division for the enumeration of sandalwood trees in patta lands. Mr. P. Shanmugasundaram Pillai, Trained Forester First grade, appointed to act as Ranger Seventh grade and posted to Anchetti Range, Salem North division, vice No. 1.

7—10—34. The posting of Ranger Subbanarayanan on special duty in Salem North division on relief by Trained Forester S. Rangamannar Doss is hereby cancelled.

10—10—34. Mr. B. V. Vaideeswara Ayyar, Tirupattur Range. will relieve Mr., M. Pakiyanathan from Krishnagiri Range and will remain in additional charge of the latter Range, until Ranger E. W. Fernandez, now in charge of the Sandalwood sale depot, takes charge of the Krishnagiri Range.

29—10—34. Mr. S. Rangamannar Doss, Trained Forester, Salem North division, posted to Krishnagiri Range, Vellore West division relieving Ranger B. V. Vaideeswara Ayyar.

9—11—34. Mr. S. Rangamannar Doss, Trained Forester First grade. will be acting Ranger Seventh grade, vice Mr. K. Karunakara Nambiyar, Ranger Second grade, on leave.

9—11—34. Mr. M. B. Kalappa, Trained Forester First grade, vice Mr. P. Krishnaswami Mudaliar, Ranger Fourth grade on leave.

27—11—34. Mr. K. Karunakara Nambiyar, Ranger Second grade, granted extension of leave for three months from 24–11–1934.

6—12—34. Mr P. K. Subbanarayana Ayyar, on return from leave on 15–12–1934, posted to Mamandur Range, Chittoor division, vice Ranger C. N. Narasimha Chari, services dispensed with. 2. This cancells his posting for Sandalwood enumeration work,

13—12—34. Mr. S. V. Duraiswami Ayyar, on return from leave on 22–12–1934, posted to Namakkal Range, Salem South Division, *vice* Mr. T. N. Vedantaramanujam.

20—12—34. In continuation of this office Service Order No. 74 of 1934, dated 5–10–1934, Mr. P. Shanmugasundaram Pillai, Ranger Seventh grade, Temporary, granted extension of leave for one month from 7–1–1935.

21—12—34. Mr. T. N. Vedantaramanujam, Namakkal range, on relief by Mr. S. V. Duraiswami Ayyar, on 3–1–1935, transferred to Chittoor division and posted to Chandragiri Range. 2. On relief by No. 1 Mr. T. S. Sankaranarayana Ayyar, to Gudiyattam Range, Chittoor division, vice Mr. S. Ramalinga Ayyar, Ranger Seventh grade, proceeding on leave.

6—1—35. Mr. T. N. Vedantaramanujam relieved from Namakkal Range, on 3–1–1935, posted Chamala range, Chittoor division, 2. On relief by No. 1 Mr. H. E. MacBride trrnsferred to Vellore West division and posted to Tirupattur range to relieve Mr. B. V. Vaideeswara Ayyar granted one month's leave. 3. On return from leave, Mr. B. V. Vaideeswara Ayyar posted to

Attur range, Salem South division. 4, On relief by No. 3 Mr. S. M. Srinivasagram Pillai, posted to Turaiyur range, Salem South division. 5. On relief by No. 4, Mr. Syed Munavar Sahib posted to Rasipur range, Salem South relieving Mr. T. K. Perthasarathy Ayyangar. 6. Orders regarding the posting of Mr. T.K. Parthasarathy Ayyangar Ranger Sixth grade will be issued later.

Coimbatore Circle.

29—9—34. A. R. Manuals, on relief from special duty in connection with the preparation of a working plan for Tanjore, posted to Natham Range, Madura Division. 2. Mr. V. Maragathavelu, Forester First grade, will be in charge Natham Range from 13—9—1934 (on which date Ranger P. Doraiswamy Iyer was relieved by him to proceed on leave) until relieved by Ranger A. R. Manuels. No. 2 cannot draw acting Ranger's pay as present strength of Rangers in the Circle does not admit of Foresters being promoted to act as Rangers.

6—10—34. Mr. C. Thiruvengadam Pillai, Ranger Fifth grade, Coimbatore South Division granted extension of leave for 2 2 months from 20—9—1934 in continuation of the leave for two months from 20—7—1934 granted.

14—11—34, P. Doraiswamy Ayyar, Ranger Second, grade, Natham Range, granted leave for 4 months with effect from 13-9-1934,

3—12—34. Mr. P. Ramswamy Ayyar, granted extension of leave for one month from 3—12—1934 in continuation of the leave for two months from 3—10—1934 granted.

3—12—1934. Mr. P. A. Venkataraman, Senior Instructor, Vernacular Training School, posted to Pollachi Range, Coimbatore South Division after the school session ends. 2. Mr. A. M. Srinivasan Junior Instructor Vernacular Training School, posted to Pollachi depot.

16—12—34. 1. Mr. A. Sitarama Sarma, Sandalwood depot, Satyamangalam, transferred to Talamalai Range. 2. Mr. A. B. Fenn, Talamalai Range, transferred to Srivilliputtur Range in Tinnevelly Division. 3. Mr. S. V. Nagalingam Pillai, Srivilliputtur Range, transferred to Sandalwood depot at Satyamangalam.

19—12—34. 1. Mr. P. Doraiswamy Iyer on expiry of his leave, to the Pollachi depot, Pollachi, Coimbatore South Division. 2. Mr. A. M. Srinivasan, in charge of Pollachi depot, on relief by No. I will remain attached to the Coimbatore South Division. 3. Mr. P. Ramaswamy Iyer on return from leave will be attached to the Coimbatore North Division for special duty.

The posting of Ranger P. Ramaswamy Iyer to Pollachi Range is cancelled.

Ootacamund Circle.

6—10—34. On relief by Mr. P. A. Madhavan on 11th October 1934, Mr. Thomas Thachil, Range Officer, Mudumalai Range, granted leave for four months.

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25—10—34. Mr. B. M. Coates, Ranger Fifth grade, Assistant Range Officer, Begur, granted leave for 1½ months from 8th November 1934 with permission to affix Christmas holidays.

22—11—34. Mr. K. Shankaranaraina Rao, Ranger Fourth grade, on expiry of the leave posted to Coondapur Range, Mangalore North division.

9—12—34. Mr. K. Shankaranarayana Rao, on expiry of the leave posted to the charge of Sigur Range, Nilgiris Division.

This cancels his posting to Coondapur Range.

4—1—35. Mr. P. A. Madhavan, Mudumalai Range, placed in full additional charge of Sigur Range, with effect from the afternoon of 6th December 1934, till Ranger K. Shankaranarayana Rao joins duty.

Athmalik State. (ORISSA) :

Mr. A. N. Mahakud, M. R. H., who passed out of the College in 1932, has now been appointed State Forest Officer, Athmalik State, Orissa.

Obituary Note : (K. Virapam Boi.)

We very much regret to record the death of Junior Student K. Virapam Bhoi, at the Ootacamund hospital, of blackwater fever, on the 16th January. He was a hard working student and vice-captain for cricket. In his death the College has lost a keen sportsman.

We offer our condolence to his bereaved family.

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